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UNITED STATES OF AMERICA:
WAR DEPARTMENT.

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MONTHLY WEATHER REVIEW.

(GENERAL WEATHER SERVICE OF THE UNITED STATES.)

JANUARY, 1884.

PREPARED UNDER THE DIRECTION OF
BRIG. & BVT. MAJ. GEN'L W. B. HAZEN,
CHIEF SIGNAL OFFICER OF THE ARMY.

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List of merchant marine steam and sailing vessels from which International Simultaneous Meteorological reports were received at the Office of the Chief Signal Officer, U. S. Army, Washington, D. C., in time to be used in the preparation of the Weather Review for the month of January, 1984.

Name of vessel.	Observers.	Name of vessel.	Observers.	Name of vessel.	Observers.
Allen Line.		Monarch Line.		Thingalla Line.	
Br. s. s. Circassian.....	Capt. W. H. Smith.	Br. s. s. Assyrian Monarch.....	Capt. John Harrison.	Dan. s. s. Thingalla.....	Capt. S. T. H. Laub.
Grecian.....	C. E. Le Gallais.				
Nova Scotian.....	W. Richardson.	Morgan's La. & Texas Steamship Co.		Warner and Merritt Line.	
Sardinian.....	Joseph E. Dutton.	Am. s. s. Chalmette.....	Fred. Read.	Am. s. s. D. J. Foley.....	Peter F. Miller.
Scandinavian.....	John Park.	Lone Star.....	R. B. Quick.		
		New York.....	H. S. Quick.	Warren Line.	
American Line.		National Line.		Br. p. s. Iowa.....	Samuel Walters.
Br. s. s. British Crown.....	Rich'd Wills.	Br. s. s. Canada.....	John Robinson.		
British Prince.....	Geo. C. Burton.	Denmark.....	Wm. Tyson.	White Cross Line.	
British Princess.....	E. H. Fresh.	England.....	T. P. Healey.	Belg. s. s. Daniel Steinmann.....	H. Schoonhoven.
Lord Clive.....	P. Urquhart.	Erin.....	W. Arth. Griffiths.	Plantyn.....	Robt. Scott.
Lord Gough.....	E. M. Hughes.	Greece.....	W. Pearce.		
Ohio.....	Henry Morrison.	Holland.....	A. Jeffrey.	White Star Line.	
Pennsylvania.....	Geo. H. Dodge.	The Queen.....	Geo. Cochran.	Br. s. s. Adriatic.....	H. Parsell.
				Britannic.....	H. Perry.
Anchor Line.		New York and Cuba Mail S. S. Co.		Germanic.....	C. W. Kennedy.
Br. s. s. Devonian.....	H. Young.	Am. s. s. Cienfuegos.....	F. M. Faircloth.	Republic.....	P. J. Irving.
Dorian.....	George Mitchell.				
Atlas Line.		N. Y. Havana & Mexican Mail S. S. Co.		Wilson Line.	
Br. s. s. Albia.....	J. W. Samson.	Span. s. s. Antonio Lopez.....	Eugenio Bayona.	Br. s. s. Marengo.....	J. H. Malet.
Alene.....	H. R. Hughes.	Am. s. s. City of Washington.....	J. W. Reynolds.	Romano.....	Joseph Mitchell.
Span. Alps.....	B. Moran.			Salerno.....	E. E. Wilson.
Br. Alvo.....	D. Williams.	North German Lloyd Steamship Co.			
Andes.....	R. de Khevarrieta.	Ger. s. s. America.....	G. Meyer.	Winnor Line.	
		Donau.....	R. Ring.	Am. s. s. Saxton.....	S. W. Snow.
Beaver Line.		Elbe.....	W. Willigerod.		
Br. s. s. Lake Huron.....	Wm. Bernson.	Fulda.....	Carl Undeutsch.		
Lake Manitoba.....	Geo. A. R. Scott.	General Werder.....	H. Christoffers.	Miscellaneous.	
		Habsburg.....	H. Hellmers.	Br. s. s. Donahue.....	James Ross.
Boston and Halifax Line.		Hermann.....	H. Baur.	Am. Laurel.....	P. L. Cosgrove.
Am. s. s. Carroll.....	G. H. Brown.	Leipzig.....	F. Pfeiffer.	Br. Madrid.....	M. Garson.
		Main.....	O. Heimbrück.	Radnorshire.....	S. E. Richards.
Bristol-City Line.		Neckar.....	R. Bussius.		
Br. s. s. Llandaff City.....	T. L. Weiss.	Sternberg.....	A. Jaeger.	New York Herald Weather Service.	
		Oder.....	R. Sander.	Br. s. s. Abyssinia.....	Edw. Bentley.
California and Mexican S. S. Co.		Rhein.....	H. A. F. Neynaber.	Am. Acapulco.....	S. G. Porter.
Am. s. s. Newbern.....	E. T. Rogers.	Saier.....	C. Wiegand.	Am. Algiers.....	J. H. Percy.
		Strassburg.....	H. Heinecke.	Dutch. Amsterdam.....	T. M. Lucas.
Canard Line.		Werra.....	J. Barre.	Br. City of Berlin.....	Fred Watkins.
Br. s. s. Bothnia.....	Horatio McKay.	Weser.....	H. Bruns.	Am. City of Alexandria.....	F. Timmerman.
Gallia.....	Wm. McMickan.			Am. Colon.....	W. G. Shackford.
Pavonia.....	Wm. McNay.	Ocean Steamship Company.		Br. Furnessia.....	J. Heddewick.
Samarita.....	B. Woolfenden.	Am. s. s. City of Augusta.....	K. S. Nickerson.	Dutch. Maudslayi.....	G. Bakker.
Scythia.....	M. Murphy.	Old Regular Line for Buenos Ayres.		Br. Rialto.....	W. Abbott.
		Am. s. s. Mendoza.....	Geo. W. Tucker.		
General Trans-Atlantic Steamship Co.				Sailing vessels.	
Fr. s. s. Canada.....	E. Frangeul.	Oregon Improvement Company.		Am. bg. Abbie Clifford.....	David W. Storer.
France.....	P. d'Hauterive.	Am. s. s. Willamette.....	L. Meyer.	Br. bg. Achsah.....	W. W. Gheen.
Labrador.....	G. Collier.			Am. bk. Adelaide.....	Alfred M. Shaw.
Olindo Rodriguez.....	Tal. Cahour.	Oregon Railway and Navigation Co.		Am. bk. Adda Duane.....	Thomas Bailey.
St. Laurent.....	M. de Jousselein.	Am. s. s. City of Chester.....	Thos. Wallace.	bg. Alcira.....	Len. F. Acherly.
		Columbia.....	Fred. Holmes.	Am. Anna A. Holton.....	Jas. W. Lindsey.
Grion Line.		Oregon.....	E. Polemann.	bk. Aquidneck.....	Geo. Smith.
Br. s. s. Arizona.....	Sam. Brooks.	Pacific Coast Steamship Company.		bk. Arthur Barton.....	L. L. Lewis.
Wisconsin.....	C. L. Rigby.	Am. s. s. Alameda.....	H. G. Morse.	Br. bk. Aureola.....	W. E. Crockett.
Wyoming.....	J. Douglas.	Alcomi.....	Chas. M. Goodall.	bk. Ariadne.....	Geo. W. Turner.
		Orizaba.....	W. E. Plummer.	Nor. bk. Belle of the Bay.....	G. L. Johannessen.
Hamburg-American Line.		Queen of the Pacific.....	John N. Ingalls.	Am. bg. Belle of the Bay.....	R. O. Welfton.
Ger. s. s. Bolzheim.....	R. Karlowa.	State of California.....	G. Debnay.	Am. bk. Belle of the Bay.....	A. J. Brown.
Frith.....	E. Kopf.			Nor. bk. Belle of the Bay.....	M. Andersen.
Leasing.....	B. Voss.	Pacific Mail Steamship Company.		Ger. bk. Belle of the Bay.....	H. Windhorst.
Rhaetia.....	H. Vogelgesang.	Am. s. s. Australia.....	A. Bannerman.	Arg. bk. Belle of the Bay.....	John T. Holt.
Rugia.....	A. Albert.	City of New York.....	Wm. B. Cobb.	Am. bk. Belle of the Bay.....	F. L. Jones.
Silesia.....	H. Barends.	City of Peking.....	G. G. Berry.	Ger. bk. Belle of the Bay.....	L. Hancock.
Westphalia.....	C. Ludwig.	City of Rio de Janeiro.....	Robt. R. Searle.	Br. bk. Belle of the Bay.....	J. Claver.
		City of Sydney.....	W. B. Seabury.	Br. bk. Belle of the Bay.....	W. Randall.
Johnson Line.		City of Tokio.....	H. G. Dearborn.	Am. bk. Belle of the Bay.....	C. O. Carter.
Br. s. s. Menimore.....	Thos. Anlot.	Colima.....	J. M. Cavarly.	Am. bk. Belle of the Bay.....	J. F. Mountfort.
Saint Albans.....	G. Nixon.	Granada.....	M. Connolly.	bk. Belle of the Bay.....	John Spalkhorst.
				bk. Belle of the Bay.....	W. H. Champlin.
Lampart and Holt's Steamship Co.		Quebec Steamship Company.		bk. Belle of the Bay.....	W. Chandler.
Br. s. s. Archimedes.....	Jon. P. Davies.	Br. s. s. Muriel.....	G. S. Locke.	bk. Belle of the Bay.....	T. E. Blagden.
Herellus.....	John Carroll.	Orinoco.....	W. J. Fraser.	bk. Belle of the Bay.....	Robt. McFarland.
Belg. Ronco.....	James Dixon.			bk. Belle of the Bay.....	L. Meyer.
Br. Sirius.....	W. H. Stapledon.	Red "D" Line.		bk. Belle of the Bay.....	M. H. Sawyer.
		Am. s. s. Caracas.....	W. M. Hopkins.	bk. Belle of the Bay.....	W. T. Richardson.
Leyland Line.		Valencia.....	Samuel Hess.	bk. Belle of the Bay.....	Jas. L. Tooker.
Br. s. s. Venetian.....	W. H. Traut.			bk. Belle of the Bay.....	Jas. S. F. McLeod.
Virginian.....	M. Fitt.	Red Star Line.		bk. Belle of the Bay.....	John H. Hines.
		Belg. s. s. Belgenland.....	Joseph Stokes.	bk. Belle of the Bay.....	H. B. Lewis.
Liverpool, Brazil, and River Plate Steam Navigation Company.		Nederland.....	H. Bushman.	bk. Belle of the Bay.....	Jas. A. Smith.
Br. s. s. Olbert.....	James Clarke.	Pennland.....	R. Weyer.	bk. Belle of the Bay.....	Alfon Alexander.
		Rhynland.....	J. C. Jamison.	bk. Belle of the Bay.....	H. F. Schive.
Mallory Line.		Switzerland.....	W. A. Beynon.	bk. Belle of the Bay.....	D. O. McIntosh.
Am. s. s. Rio Grande.....	A. C. Burrows.	Vaderland.....	Edwin Bener.	bk. Belle of the Bay.....	John Peterson.
		Wanderland.....	H. Nickels.	bk. Belle of the Bay.....	Fr. Berckmann.
Mediterranean & New York S. S. Co.		Zeeland.....	W. G. Randle.	bk. Belle of the Bay.....	C. V. Decker.
Ital. s. s. Archimede.....	Domenico Viola.		A. J. Griffin.	bk. Belle of the Bay.....	G. Tomacelli.
Br. Picqua.....	Wm. Clayton.	Rotterdam Line.		bk. Belle of the Bay.....	O. P. Sövig.
		Dutch. s. s. Zaandam.....	E. M. Chevalier.	bk. Belle of the Bay.....	P. Reitzenstein.
Merchants' & Miners' Transportation Co.				bk. Belle of the Bay.....	Chas. H. Reed.
Am. s. s. Alleghany.....	W. A. Hallett.	State Line.		bk. Belle of the Bay.....	Joseph Hand.
		Br. s. s. State of Georgia.....	G. Moodie.	bk. Belle of the Bay.....	W. W. Thompson.
Mis. & Dominion S. S. Co. (limited.)		State of Nebraska.....	A. G. Brane.	bk. Belle of the Bay.....	Nathan S. Tracy.
Br. s. s. Dominion.....	G. L. Dale.	State of Nevada.....	John A. Stewart.	bk. Belle of the Bay.....	L. P. Thomson.
Ontario.....	Jas. McAuley.			bk. Belle of the Bay.....	Lewis Ogier.
Oregon.....	H. C. Williams.				

State weather services from which meteorological reports were received in time to be used in the preparation of the Monthly Weather Review for January, 1984.

Indiana State Weather Service, under direction of Mr. W. H. Regan, Lafayette, Ind.
 Missouri State Weather Service, under direction of Prof. Francis E. Nipher, Saint Louis, Mo.
 Nebraska State Weather Service, under direction of Mr. S. R. Thompson, Lincoln, Nebr.
 Ohio State Weather Service, under direction of Prof. T. C. Mendenhall, Columbus, Ohio.
 Tennessee State Weather Service, under direction of Hon. A. J. McWhirter, Nashville, Tenn.
 Extracts have been used from records of the Central Pacific and Southern Pacific railways.

MONTHLY WEATHER REVIEW.

VOL. XII.

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No. 1

INTRODUCTION.

The general meteorological conditions which prevailed over the United States during January, 1884, as compiled from the reports from the regular and voluntary observers of the Signal Service, and from the monthly reports of state weather services, are shown in this REVIEW. Descriptions of the storms which occurred over the north Atlantic ocean are also given under "north Atlantic storms," and their approximate paths shown on chart ii. On this chart is also shown the limit within which icebergs were observed during January, and up to February 14th.

Remarkably low minimum temperatures occurred over the northern slope on the 4th, and in the Missouri, Mississippi and Ohio valleys, south Atlantic and east Gulf states during the 5th, 6th and 7th. These low temperatures were associated with high area number iii. described under "areas of high barometer." The minimum temperatures over the region from the upper lakes to New England, on the 24th, 25th and 26th, in connection with high area number vii., were also unusually low.

The mean temperature of the month averaged from $2^{\circ}.3$ to $8^{\circ}.2$ below the normal over the districts east of the one hundredth meridian, the region of greatest departure below the normal extending from the lakes to the Gulf of Mexico between the eightieth and ninetieth meridians.

The monthly precipitation was decidedly excessive in the districts on the Atlantic coast, while in the Pacific coast regions large deficiencies occurred.

Eighteen atmospheric depressions are described under "areas of low barometer." The paths of the centres of fourteen of these are shown on chart i.

In the preparation of this REVIEW the following data, received up to February 20th, 1884, have been used, viz.: the regular tri-daily weather-charts, containing data of simultaneous observations taken at one hundred and twenty-two Signal Service stations and fourteen Canadian stations, as telegraphed to this office; one hundred and sixty-four monthly journals, and one hundred and fifty-one monthly means from the former, and fourteen monthly means from the latter; two hundred and seventy-one monthly registers from voluntary observers; forty-eight monthly registers from United States Army post surgeons; marine records; international simultaneous observations; marine reports, through the co-operation of the "New York Herald Weather Service;" abstracts of ships' logs, furnished by the publishers of "The New York Maritime Register;" monthly weather reports from the local weather services of Indiana, Iowa, Kansas, Nebraska, Ohio, and Tennessee, and of the Central Pacific railway company; trustworthy newspaper extracts; and special reports.

ATMOSPHERIC PRESSURE.

[Expressed in inches and hundredths.]

The distribution of mean atmospheric pressure for January, 1884, determined from the tri-daily telegraphic observations of the Signal Service, is shown by the isobarometric lines on chart iii. This chart shows that the region of greatest pressure covers parts of Colorado, Utah, Idaho, and Wyoming, where the barometric means exceeded 30.3 , and a small area in central Texas, where a maximum mean pressure of 30.3 occurred. The region between the isobars of 30.25 embraces the greater part of the United States. The more easterly isobar of 30.25 , is traced from northeastern Dakota in a southeasterly direction to northern Florida, and thence westward along the immediate Gulf coast to the boundary of Mexico. The more westerly isobar of 30.25 extends from the northern boundary of Washington Territory, first in a southerly direction to central Nevada, and thence southeastward to southern New Mexico. Over a small area (inclosed by the isobar of 30.25), including eastern Colorado and parts of adjacent states, the mean pressure was slightly below 30.25 . The highest barometric mean for the month, 30.35 , is reported from Salt Lake City, Utah.

The mean pressure for the month was least over the region from northern Michigan to the Canadian maritime provinces, and on the immediate coast of the Pacific north of Cape Mendocino, California. The lowest barometric means reported are 30.0 at Father Point, Quebec, and 30.03 at Sidney, Nova Scotia.

Compared with the mean pressure of December, 1883, there has been an increase over the whole country, except in Oregon and northern California, where a decrease ranging from $.02$ to $.05$ occurred. The increase has been greatest over the region from Illinois and Missouri southward to the Gulf of Mexico, where it varies from $.10$ to $.13$. An excess of from $.07$ to $.11$ also occurred in Nova Scotia. The changes elsewhere were less marked.

DEPARTURES FROM THE NORMAL VALUES FOR THE MONTH.

Compared with the normal pressure, deficiencies of from $.01$ to $.02$ are shown in northern California and southern Oregon; in the eastern part of the lake region, in New England and the middle Atlantic states the mean pressure has also been below the normal, the departures varying from $.01$ to $.07$. In all other districts the mean pressure has been above the normal. The departures of excess were greatest in the Rio Grande valley, where they varied from $.14$ to $.20$; in the middle and southern slopes, Missouri valley and western Gulf states they varied from $.07$ to $.13$.

BAROMETRIC RANGES.

The monthly barometric ranges were greatest in the middle Atlantic states and New England, and smallest in Arizona. They varied in the extremes from $.47$ at Forts Apache and Grant, Arizona, to 1.83 at Albany, New York.

In the several districts the monthly barometric ranges varied as follows:

New England.—From 1.28 on the summit of Mount Washington, New Hampshire, to 1.77 at Eastport, Maine.

Middle Atlantic states.—From 1.49 at Lynchburg and Norfolk, Virginia, to 1.83 at Albany, New York.

South Atlantic states.—From .86 at Jacksonville, Florida, to 1.42 at Kitty Hawk, North Carolina.

Florida peninsula.—From .52 at Key West, to .80 at Cedar Keys.

Eastern Gulf states.—From .86 at Pensacola, Florida, Mobile, Alabama, and Vicksburg, Mississippi, to .96 at New Orleans, Louisiana.

Western Gulf states.—From .84 at Palestine, Texas, to 1.03 at Fort Smith, Arkansas.

Rio Grande valley.—From .95 at Rio Grande City, Texas, to .96 at Brownsville, Texas.

Tennessee.—From .84 at Chattanooga, to 1.01 at Memphis.

Ohio valley.—From 1.05 at Louisville, Kentucky, to 1.28 at Pittsburg, Pennsylvania.

Lower lake region.—From 1.22 at Toledo, Ohio, to 1.73 at Oswego, New York.

Upper lake region.—From 1.17 at Chicago, Illinois, to 1.46 at Alpena, Michigan.

Extreme northwest.—From 1.28 at Fort Buford, Dakota, to 1.49 at Saint Vincent, Minnesota.

Upper Mississippi valley.—From 1.00 at Springfield, Illinois, to 1.26 at Saint Paul, Minnesota.

Missouri valley.—From 1.16 at Leavenworth, Kansas, to 1.34 at Yankton, Dakota.

Northern slope.—From .70 at Cheyenne, Wyoming, to .99 at North Platte, Nebraska.

Middle slope.—From .62 on the summit of Pike's Peak, Colorado, to 1.02 at Dodge City, Kansas.

Southern slope.—From .57 at Fort Davis, Texas, to .94 at Fort Concho, Texas.

Southern plateau.—From .47 at Forts Apache and Grant, Arizona, to .72 at El Paso, Texas.

Middle plateau.—1.00 at Salt Lake City, Utah.

Northern plateau.—From 1.07 at Spokane Falls, Washington Territory, to 1.18 at Lewiston, Idaho.

North Pacific coast.—From 1.11 at Fort Canby, Washington Territory, to 1.17 at Roseburg, Oregon.

Middle Pacific coast.—From .90 at Sacramento, California, to 1.15 at Cape Mendocino, California.

South Pacific coast.—From .58 at San Diego, California, to .83 at Yuma, Arizona.

AREAS OF HIGH PRESSURE.

Below are described nine areas of high-pressure. Numbers i., iii., iv., vi., and vii. were well-defined and extensive, especially iii., iv., and vii. In the plateau regions the lowest temperatures of the month generally occurred on the 1st and 2d during the presence of area number i. During the movement of number iii. the lowest temperatures were produced on the 4th in the northern slope and extreme northwest; 5th, southern slope, western Gulf states, Missouri valley and upper Mississippi valley; 5th and 6th, eastern Gulf states, south Atlantic states, Tennessee, Ohio valley, western part of lower lake region, and southern part of upper lake region; 6th and 7th, middle Atlantic states and New England coast. In central and southern Florida the lowest temperatures were reported on the 21st and 22d, during the movement of area number vi. From the northern part of the upper lake region southeastward over the northern parts of Pennsylvania, New York and New England, and in the middle slope region the lowest temperatures accompanied area number vii. on the 24th to the 26th.

I and II.—These high-pressure areas are continuations of number ix. described in the December, 1883, REVIEW. On the morning of the 1st number i. covered western Montana, Idaho and Utah, with a barometric ridge extending over western Texas; barometer at Salt Lake City, 30.83, or .59 above the normal; freezing temperature was general to Texas, with a severe "norther" on the coast, which extended across the Gulf. During the day it separated into two distinct areas, one over Nevada and the surrounding country, which lost its identity on the 4th, and the other over Texas; 1st, midnight barometer at Rio Grande City, 30.77, or .63 above the normal.

By morning of the 2d freezing weather extended eastward to western Florida, and on the morning of the 3d over the northern half of Florida, with the temperature from 20° to 30° below the normal. During the 4th it was apparently dissipated over northern Florida. Number ii. was central north of Dakota on the morning of the 1st, with a barometric ridge and temperature more than 20° below the normal extending to Kansas; barometer at Minnedosa, Manitoba, 30.90, or more than .60 above the normal. During the day it was gradually dissipated.

III.—During the 2d and 3d this high area advanced southward over the Northwest Territory, and extended its influence southeastward over the Missouri valley. On the 4th, highest barometer at Qu'Appelle 30.99, and at Fort Buford 30.93, or .76 above normal; minimum temperature at Qu'Appelle —48°, at Minnedosa, Fort Garry, and Moorhead —43°, and from 30° to 40° below the normal from Montana, Dakota, and Minnesota southeastward to the Ohio valley, Arkansas, and northwestern Texas. At night a "norther" occurred on the Texas coast, which on the 5th was felt along the entire Gulf coast. During the 5th and 6th it appeared as an extensive barometric ridge reaching from Manitoba southeastward to the Gulf states, but with slowly diminishing pressure; the temperature fell about 50° below the normal in the lower Ohio valley and Tennessee. On the 7th, in advance of low area number iv., it moved eastward over the middle Atlantic states and the 8th over New England.

IV.—On the 6th this high area appeared in California, but with the pressure only slightly above the normal. The 7th, it passed eastward to the central and southern plateau regions, and on the 8th and 9th it again withdrew northwestward to the north Pacific coast. By morning of the 10th it was central in Washington Territory; barometer at Olympia, 30.52, or .45 above the normal. During the 10th it moved southeastward and covered the country from the Pacific coast to the upper Mississippi valley and western Texas. Between it and low areas numbers vi. and vii. the gradient became steep, and high northerly winds and gales resulted from the Missouri valley to the Texas coast. On the 11th and 12th it continued nearly stationary as an extensive barometric ridge reaching from Oregon southeast to the Gulf states. The movement of low area number ix. southeast over Manitoba caused this high area to divide into two distinct areas; one passed eastward over the Gulf states during the 12th and 13th to the south Atlantic coast, where it was dissipated; the other apparently moved northwestward to Oregon and Washington Territory, and thence extended east to Manitoba and Dakota. The 14th it covered the country from Washington Territory and Oregon to the upper lake region, but with a tendency to move eastward. On the morning of the 15th the highest was central over Manitoba; in Wyoming, and from Manitoba southeast over the northern portion of the lake region to the Saint Lawrence valley, the temperature fell 20° or more below the normal—at Ottawa, Canada, 40° below. During the day it moved southward; morning of the 16th, it was central in Missouri, with fair weather throughout the United States, excepting in Texas. The 16th and 17th, it slowly moved to the South Atlantic coast, where it disappeared on the 18th.

V.—During the 15th and 16th, while number iv. was moving southeastward, this high area gradually formed over the plateau districts; it moved westward toward the Pacific coast on the 17th, northward over Washington Territory on the 18th, southward over the plateau regions on the 19th and 20th, northwest to Washington Territory the 21st, continued nearly stationary the 22d, and moved southeast to the northern slope on the 23d and 24th, where it was dissipated on the 25th.

VI.—Increasing pressure and falling temperature in Manitoba, morning of the 18th, indicated the approach of this high area; p. m. barometer at Qu'Appelle, 30.79, about .50 above normal. During the 18th and 19th it rapidly moved southward towards the western Gulf coast, producing high northerly winds in its advance and falling temperature, to more than 20° below the normal. The 20th, it continued nearly

stationary over the western Gulf states; p. m. barometer at Rio Grande City, 30.77, or .63 above normal; 21st, passed eastward over the Gulf states, and 22d, with diminishing central pressure, it moved to the south Atlantic coast, where it disappeared the 23d.

VII.—This high-pressure area was first observed as advancing southward over the Northwest Territory and Manitoba on the evening of the 22d, causing a rapid fall in the temperature in Dakota and Minnesota. During the 23d the central highest pressure moved southward to the lower Missouri valley; p. m. barometer at Fort Garry, 30.89, or .68 above normal. In the upper Mississippi and Missouri valleys the temperature fell from 20° to 30° below the normal, which extended to the Gulf states on the 24th; high northerly winds and gales marked its advance, which on the 23d reached the western and the 24th, the eastern Gulf coast, and the 25th, to southern Florida. It appeared as a barometric ridge reaching from southern Texas to the upper Saint Lawrence valley during the 25th, and temperature about 30° below the normal, with high northerly winds or gales along the Atlantic coast. On the 26th and 27th it slowly moved northeast toward New England and the Saint Lawrence valley; p. m. barometer, 27th, at Montreal, 30.92, or .81 above normal. The 28th and 29th, it gradually disappeared eastward beyond New England.

VIII.—While low area xvi. was off the north Pacific coast on the 28th, this high area advanced southeast over the Northwest Territory, but it was either dissipated or forced to take a northeast course by the former on the 29th.

IX.—During the night of the 29th this area formed over the southern plateau region and moved northwestward on the 30th with increasing pressure, and continued over the plateau regions on the 31st.

AREAS OF LOW BAROMETER.

The following table gives the latitude and longitude in which the centres of the several areas were first and last located, and the average hourly velocity of movement.

Areas of low barometer.	First observed.		Last observed.		Average velocity in miles per hour.
	Lat. N.	Long. W.	Lat. N.	Long. W.	
No. I.	30 45	86 00	43 30	78 00	22.5
II.	38 00	77 00	49 15	65 00	43.7
IV.	45 00	123 30	49 15	71 00	44.8
VI.	49 00	125 30	45 15	80 00	42.8
VII.	27 45	97 30	35 15	77 15	42.2
VIII.	50 15	102 30	45 45	82 00	35.9
IX.	52 30	107 30	45 45	62 30	39.3
X.	32 30	94 45	34 15	70 00	46.5
XI.	53 00	104 00	49 00	59 00	52.5
	42 30	87 00			59.4
XII.*	37 00	101 30	37 30	75 00	67.9
	30 00	92 15			55.4
XIII.	53 00	96 00	50 00	69 30	38.6
XIV†	43 00	86 15	38 30	75 45	37.1
	27 45	98 30			49.2
XVI.	47 00	128 00	39 00	123 00	10.0
XVII.	42 30	94 30	51 00	65 00	35.4

Mean hourly velocity, 42.5 miles. * Centres united in N. 37° 45', W. 85° 30'. † Centres united in N. 34° 30', W. 83° 30'.

Eighteen low areas are described below. The paths of the centres of fourteen have been charted; those of numbers iii., v., xv., and xviii. were beyond the limits of the stations. In New England, southeastern parts of New York and Pennsylvania, New Jersey, Delaware, Maryland, and District of Columbia the highest temperatures of the month were recorded on the 9th, during the movement northeastward of low area number iv.; in Montana, Dakota, Wyoming, and northern Colorado on the 12th, during the progress southeast of low area number ix.; in the eastern parts of North Carolina and Virginia on the 24th, during the movement of low area number xiv.; in the Gulf states, northern Florida, Georgia, Kansas, upper Mississippi valley, Ohio valley, northern New York, lower lake region, and upper lake region, excepting along Lake Superior, on the 29th, 30th or 31st, during the progress northeastward of low area number xvii.

Excepting Milwaukee, Grand Haven, Ludington, and Saint

Joseph, on Lake Michigan, signals were not displayed at lake stations during the month, on account of navigation having been closed.

I. and II.—During the progress northeast of number i. on the 1st, rainy weather prevailed in the Southern states, with winds veering to brisk and high northerly, but thence northward to New England and the lake region it changed to snow, with brisk to high northeasterly winds, and to the upper Mississippi and Missouri valleys, with northerly winds. By morning of the 2d number ii. had developed, and was central in eastern Virginia. Northeast gales prevailed along the Atlantic coast and in the lake region, with snow and rain in the advance quadrants, and they were followed by northwest gales and much colder, clearing weather on the 2d; midnight barometer at Eastport, 28.98, or 1.07 below normal. Maximum hourly wind-velocities: Fort Elliott, nw., 44; Indianola, n., 54; Galveston, n., 38; Cedar Keys, nw., 35; Key West, n., 36; Fort Macon, w., 47; Delaware Breakwater, w., 36; Sandy Hook, e., 38 and w., 44; Block Island, sw. and nw., 44; Eastport, se., 40; Duluth, w., 36; Milwaukee, ne., 34 and w., 35; Grand Haven, w., 44; Port Huron, w., 36; Toledo, ne., 35 and sw., 39; Cleveland, sw., 38; Buffalo, w., 59; Rochester, w., 43; Mount Washington, se., 70 and nw., 108 miles. Cautionary off-shore signals were ordered, morning of the 1st, for Indianola and Galveston, but they were late; cautionary signals, from Fort Macon to Sandy Hook, and in the afternoon for Lake Michigan (late) and along the New England coast. During the 2d the cautionary signals were changed to off-shore signals along the coast from North Carolina to Maine, and off-shore signals hoisted at Key West. All were fully justified.

III.—After the preceding disturbances had passed to the northeast a barometric trough was left on the 4th, which extended at night over the south Atlantic and Gulf states, and in which this low developed. On the 5th it rapidly moved northeast off the middle Atlantic coast; its track has not been charted; snow fell from South Carolina and northern Georgia to New Jersey. During the 6th it continued its northern course beyond, and to the southeast of, Nova Scotia. Maximum velocities: Fort Macon, n., 48; Kitty Hawk, ne., 60; Cape Henry, n., 46; Chincoteague and Delaware Breakwater, n., 40; Sandy Hook, w., 41; Block Island, n., 32; Mount Washington, nw., 104 miles. On the 4th off-shore signals were ordered for the Gulf, South Carolina and North Carolina coasts, and cautionary signals from Cape Henry to Cape Cod; the 5th, off-shore from Savannah to Jacksonville and at Key West, and cautionary at Cedar Keys. They were generally justified.

IV.—Falling barometer, southeasterly winds increasing to gales on the coast, and threatening weather followed by rain, and changing to snow over the interior, prevailed from northwestern California to Washington Territory from the 1st to the 5th. During the 2d a secondary depression developed between high areas numbers i. and iii., and passed southeast over Idaho, Wyoming, and Colorado, and on the 3d to Texas. The daily charts show that this secondary depression moved east over the Gulf states during the 4th, and assisted in the formation of low area, number iii., on the 5th. Rain became general in the northern half of California on the 5th, with high southerly winds; at Cape Mendocino the barometer fell to 29.55 at noon, and at Fort Canby (Cape Disappointment) to 29.43, or .64 below the mean, during the evening. On the 6th the central depression quickly passed southeast over Utah to western Texas, accompanied by light rains or snow. During the 7th high winds prevailed along the Gulf coast, with rain, changing to snow in Tennessee, Arkansas, Missouri, and the Ohio valley. On the 8th clearing weather followed it in the Gulf states; easterly gales preceded it along the Atlantic coast, with heavy rain, which changed to snow over the interior to the lower lake region. During the 9th easterly gales with snow turning to rain preceded it from New England to the Saint Lawrence valley and the Canadian maritime provinces, while high northwesterly winds or gales and much colder, clearing weather succeeded it throughout the Atlantic

states; lowest barometer, 28.96 at Montreal, and 1.08 below the normal at Philadelphia. Maximum velocities: Fort Canby, se., 72; Cape Mendocino, se., 100; San Francisco, se., 28; Indianola, n., 49; Smithville, se., 49; Kitty Hawk, se., 60; Delaware Breakwater, se., 44; Sandy Hook, e., 58; Block Island, se., 44; Provincetown, se., 53; Boston, se., 48; Portland, e., 56; Eastport, se., 46; Toledo, n., 32; Buffalo, sw., 41; Rochester, w., 44; Mount Washington, se., 112 and nw., 130 miles. Cautionary signals were ordered on the 6th for the Texas coast; the 7th, for the remainder of the Gulf, the south Atlantic and middle Atlantic coasts; the 8th, for the New England coast. All were in good time and well justified. Warnings were also sent on the 8th for Canadian stations in Nova Scotia, and 9th, for those in the Saint Lawrence valley and along the Gulf of Saint Lawrence.

V.—During the 6th, after low area number iv. had passed southeastward, the pressure again diminished along the north Pacific coast, with southeasterly winds increasing to gales, and rainy weather. On the 7th and 8th it apparently moved northeast over the Northwest Territory. Maximum velocities: Cape Mendocino, se., 68; Fort Canby, s., 64; Fort Benton, sw., 36; Medicine Hat, s., 45; Fort Garry, s., 35 miles.

VI and VII.—Before the barometer had reached the normal, succeeding low area number v., on the north Pacific coast, it again fell on the 8th, with continued rainy weather and high southerly winds; noon, barometer at Olympia .46 below normal. The central depression rapidly moved eastward and by morning of the 9th had reached the northern boundary of Dakota; during that day and the 10th high westerly winds and snow prevailed in its western quadrants. Number vii. formed over Texas on the 10th in the barometric trough which was produced in that direction by number vi. Between these two and high area number iv., from the Missouri valley to Texas, the gradient became quite steep, resulting in high northerly winds. On the 11th rainy weather prevailed in the Gulf and South Atlantic states, and rain turning to snow from Tennessee northeast to New England. Maximum velocities: Fort Canby, s., 48; Fort Maginnis, nw., 48; Fort Buford, nw., 42; Fort Bennett, nw., 40; Dodge City, n., 36; Fort Elliott, n., 45; Fort Concho, n., 40; Brownsville, s., 41; Indianola, n., 48; Kitty Hawk, ne., 32; Delaware Breakwater, w., 42 miles. Cautionary signals were ordered for Lake Michigan on the 9th; 10th, off-shore signals at Indianola and Galveston, and cautionary at New Orleans, Mobile and Pensacola; 11th, on the North Carolina coast. They were generally justified.

VIII.—This disturbance advanced southeast from the Northwest Territory on the 10th. During the 11th light snows accompanied it in the extreme northwest, upper Mississippi valley, and upper lake region, and southwest veering to northwest gales in its western quadrants; on the 12th light snows and brisk winds in the lake region and upper Ohio valley. Maximum velocities: Medicine Hat, sw., 50; Forts Shaw and Assinaboine, sw., 44; Fort Maginnis, sw., 52; Fort Buford, w., 37; Cheyenne, nw., 42 miles. Signals were continued for this storm on Lake Michigan, but not justified as to velocity.

IX.—Like the preceding, this storm moved southeast over the Northwest Territory and Manitoba on the 12th, with snow in latter and with southerly veering to northerly gales in former and Montana. During the 13th light snow or rain and brisk to high southerly winds veering to westerly accompanied it from the upper Mississippi valley eastward of the lake region to New England and the Saint Lawrence valley, followed by clearing weather on the 14th. Maximum velocities: Medicine Hat, sw., 55; Forts Shaw and Assinaboine, sw., 48; Fort Maginnis, ne., 48; Fort Buford, nw., 37; Saint Vincent, n., 32; Milwaukee and Grand Haven, s., 29; Buffalo, w., 46; Delaware Breakwater, sw., 52; Block Island, sw., 32; Mount Washington, sw., 79 miles. Cautionary signals were ordered for Lake Michigan on the 12th; 13th, for the New England coast, and off-shore along the middle Atlantic coast. All were justified.

X.—As number ix. progressed eastward a barometric trough

was formed to the southwest, in which, by morning of the 14th, this slight disturbance developed. Rain accompanied it in the Gulf states and Tennessee, and snow in the Ohio valley during that date; light rains at night extended to the south Atlantic states, and mostly as snow in the middle Atlantic states. Maximum velocities: Fort Macon, nw., 32; Kitty Hawk, ne., 38; Delaware Breakwater, ne., 36; Sandy Hook, ne., 38 miles. Cautionary signals were ordered on the 14th, for Lake Michigan, and along the coast from North Carolina to Massachusetts. Those along Lake Michigan and the southern New England coast were not justified.

XI.—There were indications of the approach of a disturbance from the Northwest Territory on the 15th. As it advanced southeast during the 16th and 17th, high southwesterly winds, were occasionally reported in its southwestern quadrant. Maximum velocities: Forts Assinaboine, Shaw, and Maginnis, sw., 36; Mackinac City, sw., 36; Rochester, sw., 43 miles. Cautionary signals were displayed on Lake Michigan on the 17th, and justified; also on the New England coast, and partly justified.

XII.—This low area resulted from a combination of three minor depressions. On the evening of the 14th a disturbance existed south of California. During its progress eastward light rains or snow accompanied it on the 15th, 16th, and 17th from southern California to the Gulf states. During the 17th a barometric trough formed to the southwest from low area number xi. In that trough two distinct depressions developed on the 18th, and the three united as shown on the chart; threatening weather, with rain, prevailed in the Southern, and southern part of the middle, Atlantic states, changing to snow from the Missouri valley eastward over the lake region. At night the advance of high area number vi. produced a steep gradient from the Missouri valley to the Texas coast, and high northerly winds. During the 19th light rains continued in the southern part of the middle Atlantic states, changing to snow thence over New England, the lower lake region, Ohio valley, and Tennessee, and clearing weather in the south Atlantic and Gulf states. On the 20th, clearing weather succeeded light snows from the New England and middle Atlantic coasts to the lower lakes, Ohio valley and Tennessee. Maximum velocities: Indianola, ne., 35; Pike's Peak, nw., 52; Fort Elliott, n., 40; Duluth, ne., 32; Milwaukee, n., 34; Fort Macon, s., 31; Sandy Hook, ne., 32; Block Island, n., 40; Eastport, ne., 32 miles. Cautionary signals were ordered on the 18th on Lake Michigan, and from North Carolina to New Jersey, and off-shore for the Texas coast; 19th, cautionary signals for the New England coast. They were justified, but lowered too early on the middle Atlantic and North Carolina coasts. Warnings were also sent for the Canadian stations in Nova Scotia on the 19th.

XIII and XIV.—On the 20th the observations from Manitoba and the Northwest Territory indicated the presence of a disturbance to the northward. Generally fair weather prevailed in the lake region on the 21st, with brisk to high southerly veering to westerly winds; also on the 22d in the middle Atlantic and New England states. During the latter date an extensive barometric trough formed, which reached from the upper lakes to New Mexico, and in which two distinct depressions, number xiv., developed at night, one over Lake Michigan and the other in southern Texas, with light snows from the upper lakes to the upper Missouri valley. On the 23d rainy weather prevailed in the Gulf states, changing to snow thence to the lakes. To the westward of these depressions high area number vii. was moving southward over the Missouri valley, causing a steep gradient between them, and high northerly winds. During the 24th the two depressions united and quickly moved northeast over the middle Atlantic coast. Clearing, and much colder, weather followed in the Gulf states, Tennessee, Ohio valley and lake region; the rain-area covered the Atlantic coast districts, with high winds from North Carolina northeastward, but followed by much colder, clearing weather afternoon or night of the 25th. Maximum velocities: Fort Maginnis, nw., 34; Grand Haven, sw., 36; Buffalo, sw., 34; Eastport, s., 32;

Omaha, Dodge City and Fort Elliott, n., 32; Fort Concho, s. and n., 32; Brownsville, s., 39; Indianola, n., 42; Smithville, s., 36; Kitty Hawk, se., 38; Delaware Breakwater, nw., 36; Block Island, s., 32 miles. Cautionary signals were ordered on the 21st for Lake Michigan; 21st and 22d, along the coast from North Carolina to Maine; 22d, for Texas coast; 23d, for the middle Atlantic, south Atlantic, and remainder of Gulf coast; 24th, for New England coast. They were generally justified. Warnings were sent for the stations in Nova Scotia on the 24th.

XV.—The track of the centre of this disturbance has not been charted. It passed eastward over the Northwest Territory and Manitoba on the 23d and 24th, and was probably forced to take a more northerly course by high area number vii., then over the lower Missouri valley. High velocities: Qu'Appelle, sw. and nw., 30; Fort Maginnis, w., 47; Fort Buford, w., 36; Fort Garry and Saint Vincent, s., 38 miles.

XVI.—This storm probably moved southward off the Pacific coast, as shown on the chart, accompanied by severe southerly gales in the Pacific coast districts, with heavy rains. Lowest barometer, 29.27, at Cape Mendocino, or .79 below the normal on the 26th. It sent out to the eastward several secondary depressions across the plateau regions which on the 27th and 28th caused cloudy weather east of the Rocky mountains, with light rains in the southern and central districts, and light snows in the northern districts. Maximum velocities: Fort Canby, e., 46; Cape Mendocino, se., 100; Red Bluff, s., 36; Sacramento, s., 30; San Pedro, se., strong gale; San Diego, s., 31 miles. Signals were ordered for Lake Michigan on the 27th; on the coast from Maine to Delaware on the 28th, but were only partly justified.

XVII.—Although its track cannot be definitely traced, the tri-daily weather charts show that this disturbance developed from low area number xvi., and crossed the plateau regions on the 28th. During the 29th, as it moved toward Lake Superior, light snow fell in its northern, and light rains in its southern, quadrants. On the 30th light rains prevailed from Tennessee and the middle Atlantic and New England coasts to the lakes, but partly as snow in the upper lake region and upper Mississippi valley, with brisk to high southerly veering to westerly winds. Maximum velocities: Salt Lake City, se., 32; Pike's Peak, sw., 73; Prescott, s., 30; Fort Concho, s., 36; Cheyenne, nw., 34; Milwaukee, w. 38; Port Huron, nw., 35; Rochester, w., 44; Delaware Breakwater, w., 40; Eastport, s., 29; Mount Washington, sw., 116 and nw., 88 miles. Cautionary signals were ordered up on Lake Michigan on the 29th; along the coast from Virginia to Maine, 30th; North Carolina coast, 31st. Excepting some of the New England stations, they were justified.

XVIII.—During the 31st this storm was advancing southeast over the Northwest Territory, causing westerly gales in Montana; at midnight it was central some distance north of the limit of the stations. Maximum velocities: Medicine Hat, s., 60; Fort Assinaboine, sw., 40; Fort Shaw, sw., 48; Fort Maginnis, nw., 48 miles.

NORTH ATLANTIC STORMS DURING JANUARY, 1884.

[Pressure expressed in inches and in millimetres; wind-force by scale of 0-10.]

Chart ii. exhibits the tracks of the more important atmospheric depressions that have appeared over the north Atlantic ocean during January, 1884. The location of the various storm-centres has been approximately determined from reports of observations furnished by agents and captains of ocean steamships and sailing vessels, and from other miscellaneous data received at this office up to February 21, 1884.

The observations are, in general, simultaneous, being taken each day at 7 h. 0 m. a. m., Washington, or 0 h. 8 m. p. m., Greenwich, mean time.

Of the twelve depressions charted, five were apparently continuations of disturbances which passed over the United States and the Canadian maritime provinces; two were first observed near the sixtieth meridian, and the remaining five

appear to have originated to the eastward of 40° west longitude. Of the latter, that charted as number x. was remarkable on account of the great damage it caused in the British Isles and northwestern Europe, and for the extraordinary depth of the atmospheric depression, the barometer near the centre of disturbance having fallen to 27.65 (702.2). With the exception of number x., none of the disturbances appear to have exhibited any great storm-energy; the month was, however, characterized by a succession of strong westerly breezes to fresh gales, with frequent fogs to the westward of the forty-fifth meridian, during the closing days of the month.

The following are brief descriptions of the depressions charted:

I.—This was probably a continuation of the disturbance charted as x. on the chart for December, 1883. At the close of that month it was central near N. 50°, W. 40°, the atmospheric pressure ranging from 29.65 (753.1) to 29.8 (756.9). By January 1st the region of least pressure was about N. 46°, W. 35°, the barometer having fallen to 29.17 (740.9). The area of the disturbance was apparently extensive, since vessels as far south as N. 36°, W. 39° had fresh northwesterly gales of force 7 to 8, with barometer about 29.55 (750.6), and those on the twenty-eighth and thirtieth parallels had fresh to strong westerly and southwesterly breezes, and pressure ranging from 29.75 (755.6) to 29.85 (758.2). Between N. 48° and 52° moderate to fresh easterly to southerly winds prevailed, with pressure ranging from 29.28 (743.7) to 29.85 (758.2). The disturbance moved slowly northeastward, and on the 2d it was central near N. 47°, W. 29°, the pressure remaining about 29.15 (740.4); the winds remained moderate in force over the region near, and to the eastward of, the centre, but to the westward of the centre they attained the force of a moderate to fresh gale. On the 3d the reports showed the centre of disturbance to be near N. 49°, W. 27°, the pressure having fallen to 28.86 (733.0). The s. s. "Olinde Rodrigues," P. Cahour, commanding, reported, in N. 47° 42', W. 27° 06', barometer, 28.86 (733.0), wind sw., force, 6, high nw. sea, and cloudy weather. The s. s. "Assyrian Monarch," J. Harrison, commanding, in N. 47° 56', W. 30° 30', reported barometer 29.16 (740.7), wind nne., force 7, heavy ne. swell, cloudy. Moderate to strong northerly and northwesterly gales, with pressure ranging from 29.16 (740.7) to 29.51 (749.5), prevailed over the region between W. 30° and 40°, while fresh to strong breezes only were reported in front of the centre of disturbance. On the 4th the storm-centre was near N. 51°, W. 22°, where the pressure was about 29.5 (749.3), with moderate easterly breezes to the northward of the fifty-first parallel. During the day the disturbance moved apparently in a north-northeasterly direction, and on the 5th it was central north of the fifty-fifth parallel and near W. 13°. On that date the s. s. "Circassian," Lieut. W. H. Smith, R. N. R., commanding, reported, in N. 55° 40', W. 13° 10', barometer 29.21 (741.9), wind w., force 3, overcast and showery. By the morning of the 6th the disturbance was central to the northeastward of Scotland.

II.—This was probably a continuation of the disturbance described as low area number iii., but not charted on chart i. of this REVIEW. At midnight of the 5th the centre was off the New England coast, and by the morning of the 6th the marine reports indicated its presence in about N. 42°, W. 60°. The s. s. "Neckar," R. Bussius, commanding, reported in N. 40° 43', W. 59° 32', barometer 29.31 (744.5), wind nw. to ssw., force 5 to 8, high cross sea from sw. Moderate northerly gales prevailed between W. 65° and 70°, and near the fortieth parallel, and strong westerly and northwesterly gales were reported by vessels near N. 35° and between W. 65° and 72°, while moderate southerly and southeasterly winds occurred to the eastward of W. 62°. At the same time another depression appears to have been passing northeastward over Newfoundland, as vessels to the northward of N. 45°, and between W. 48° and 54°, reported fresh to strong southwest to northwest gales, with rain and snow-squalls, and the schooner "Excel," fifty miles west of Saint Pierre, Newfoundland, lost

boats, etc., in a heavy nw. gale. The depression moved rapidly northeastward, and on the 7th it was near N. 50°, W. 38°; the s. s. "Nova Scotian," W. Richardson, commanding, reported in N. 51° 16', W. 36° 52', barometer, 29.38 (746.2), wind w. by s., force 7, heavy rain. Strong southerly and southwesterly gales were reported between N. 45° and 55°, and W. 38° and 28°; vessels to the westward of the fortieth meridian and south of N. 45°, had moderate to strong westerly and northwesterly gales. On the 8th the disturbance was shown near N. 55°, W. 27°, where the lowest reported pressure was 29.5 (749.3). East of 25° west longitude, the winds shifted from west to southwest and south, and blew with the force of a fresh gale, and strong westerly and northwesterly winds now prevailed over the ocean between W. 25° and 55°. Moving northeastward during the day, the disturbance appeared off the northwestern coast of Scotland on the 9th, and passed beyond the limits of the observations as yet to hand.

III.—This was a continuation of low area iv. of chart i. During its passage northeastward along the coast on the 8th and 9th, it caused very heavy southeast to southwest gales from the coast of the United States eastward to the seventieth meridian, and between N. 30° and 40°; north of the fortieth parallel, strong northeasterly winds prevailed. Several vessels were driven ashore, while others lost sails, spars, etc. The following reports indicate the severity of the gale. 7th, brig "Osseo," in N. 30°, W. 74°, had a hurricane from se., lasting forty-eight hours, carried away rudder head; 8th, bark "Belle Wooster," between Hatteras and Lookout, had a heavy se. gale with high cross sea, in which she lost and split sails; the schooner "Eleanor," off Hatteras, lost deck-load, had cabin-house stove and filled, sails split, and received other damage. On the same date the schooners "Emma C. Rommel" and "John N. Parker" drove ashore near Hatteras during the furious se. gale; the schooner "Maggie M. Rives" was abandoned in N. 34°, W. 76° 07', having been dismasted and become water-logged during this gale. The steamer "Flamborough," from the West Indies for New York, also encountered heavy weather on the 8th and 9th; the s. s. "Tangier," in N. 36°, W. 71°, lost port lifeboat, stove main-rail, and did other damage during a heavy s. gale on the 9th. Captain Clarke, commanding the s. s. "Olbers," reported on the 8th, "6 p. m., fresh se. gale, threatening weather, wind increasing and gradually veering to s., with falling barometer, high sea making up; 11 p. m., high confused sea from se. and e., with light rain; 9th, N. 33° 50', W. 69° 55', heavy s. gale, barometer 29.74 (755.4), dark and squally, with rain, wind veering to sw.; 4 p. m., heavy squalls, wind veering to w., with very high confused sea running; squally, with rain and hail during the night, and moderating towards 8 a. m. of the 10th." Captain Ogier, of the schooner "Viola Repard," in about N. 41°, W. 71°, reported: "8th, 2 p. m., fresh se. gale; 4 p. m., gale increasing, hove ship to, high se. sea; 9th, wind same, with rain, hail and snow; 10 a. m. moderating; 2 p. m., wind hauling to sw. and wnw., blowing, if possible, harder than ever, rain, hail and snow, with fearfully high cross sea." Captain Sawyer, of the bark "Ibis," in about N. 38° 43', W. 71° 40', reported, "the gale of the 9th and 10th, was very severe for thirteen hours, and a very heavy sea rolled up from se., and afterwards from sw. While the gale continued from se. it was attended by rain, but after hauling to sw. it cleared off. This gale revolved from ne. (where it began) to se., thence to wsw., (where it finished). The barometer fell very quickly on the approach of the gale and at midnight of the 9th, it read 29.16 (740.7)." The schooner "Anna A. Holton," G. Smith, commanding, took the gale in about N. 35° W. 74° on the 8th, and stove bulwarks, stanchions, and sustained other damage. Captain Powell, of the bark "Aquidneck," reported that when the gale began, about 1 h. 30 m., Greenwich time, of the 8th, the barometer read 30.45 (773.4), but falling rapidly, and wind freshening from se.; the ship was hove to in about N. 34° 54', W. 74° 03', and the wind and sea continued to increase in violence, the barometer reaching its lowest point, 29.4 (746.7), at 17 h. of the 8th. Captain Powell reported that he never

saw such a fearfully high sea, and estimated the velocity of the wind to be about eighty miles an hour; the spray went over the fore and main yards. By the morning of the 10th the disturbance had reached the Gulf of Saint Lawrence, followed by westerly and northwesterly gales in its rear. On the 11th and 12th the depression moved northeastward with decreasing energy, and apparently filled up on the last-mentioned date.

IV.—This was probably a continuation of low area vii. of chart i. It passed off the North Carolina coast into the Atlantic on the 11th, and moving northeastward during the 12th, it appeared south of Newfoundland on the following day, when the lowest reported pressure, 29.42 (747.3), was observed in N. 46° 9', W. 53° 26', on board the s. s. "Circassian." On the 14th, the depression was near N. 48°, W. 45°, where the barometer read 29.75 (755.6). Northerly and westerly winds of moderate force prevailed over the region west of W. 48°, and moderate southerly winds were reported to the eastward of W. 40°. On the 15th the region of least pressure was in N. 51°, W. 40°; the lowest reported barometric reading was 29.39 (746.5), wind sw., force 8, observed in N. 49° 34', W. 42° 54' by Captain C. Wiegand, commanding the s. s. "Salier." The southerly winds increased somewhat in force over the region east of the centre of depression, but the winds in its rear remained moderate. On the 16th the disturbance moved slowly eastward, and by the 17th the region of low pressures extended from W. 45° eastward to W. 28°, and moderate to strong southerly to westerly gales prevailed over that region. At the same time the area of barometric maxima, which had apparently checked the eastward movement of the depression, began to give way, and by the 18th the disturbance was shown in about N. 51°, W. 23°, near which region it remained, with gradually increasing pressure, until the 20th, when it filled up.

V.—This was a continuation of low area ix. of chart i. It passed over the Gulf of Saint Lawrence on the 14th, and, moving eastward, apparently combined with low area iv. above described.

VI.—The reports of the 19th indicated the existence of a depression north of N. 50°, and between W. 37° and 42°. The s. s. "Llandaff City," T. L. Weiss, commanding, reported in N. 48° 32', W. 37° 2', barometer 29.8 (756.9), wind s., force 7, stormy weather and rain. The disturbance moved northeastward, and on the 20th it was central north of the fifty-fifth parallel and east of W. 32°, afterwards passing beyond the range of observations. Captain Laub, commanding the s. s. "Thingvalla," reports in connection with the gale, as follows: "On the 19th, at 5 h., Greenwich time, nearly calm, wind backing to sse., barometer falling, long and increasing westerly swell; 6 h., wind-force 4, rainy weather; 8 h., wind-force 8, barometer 29.61 (752.1). At 9 h. 30 m., wind chopped to sw. in a squall, force 9, barometer 29.58 (750.0); 10 h. 15 m., barometer 29.58 (751.3), then stationary, but wind and westerly sea rapidly increasing. At 2 a. m., of the 20th, (Greenwich mean time), wind sw., force 10, sea so high that I only once or twice remember the like; barometer slowly falling till 5 a. m., 29.54 (750.3). At 7 h. 30 m., the wind began to haul to the westward, its force keeping up until 8 h. 30 m." (Ship's position, between N. 55° 50', W. 30 16', and N. 55° 5', W. 32° 10').

VII.—This was a continuation of low area xii. of chart i. It passed into the Atlantic from Virginia on the 19th, causing strong se. to nw. gales between N. 35° and 40°, and on the 20th it was central near the southern part of the Banks of Newfoundland. The barometric pressure was 29.5 (749.3), and strong southerly gales were reported to the eastward as far as W. 40°, with equally strong northerly and westerly gales to the westward of W. 50°. During the day the disturbance appears to have moved quickly northeastward and on the 21st it was shown near N. 52°, W. 30°; on the following day it moved slowly eastward and by the 23d it was off the Irish coast, attended by strong westerly gales near the fiftieth parallel. During the day the disturbance appears to have passed eastward over the British Isles towards the North sea.

VIII.—This was a slight depression which developed near the Banks of Newfoundland on the 21st; it moved northeastward without exhibiting much storm-energy, and finally dissipated on the 22d.

IX.—This was probably a continuation of low area xiv. of chart i. On the 24th the disturbance was central to the south-eastward of Nova Scotia; it appears to have remained nearly stationary, as on the 25th it was near N. 45°, W. 57°; it was, however, apparently filling up, and on the 26th it was replaced by an area of high-pressure.

X.—This was the most severe storm of the month, and, so far as can be determined from the data as yet to hand, appears to have originated east of the thirtieth meridian. An area of high-pressures occupied the ocean between W. 20° and Newfoundland, and south of 50° north latitude, during the 23d and 24th; on the 25th this began to give way, and the pressure decreased to 29.7 (754.4) and 29.5 (749.3) over the region between W. 30° and the British Isles. The pressure continued to decrease rapidly, and by the 26th all vessels between W. 30° and W. 10°, and N. 48° and 53°, reported barometric readings ranging from 28.43 (722.1) to 29.01 (736.8), with furious westerly gales and very high sea. A report of this gale published in the "Northern Whig" (Belfast newspaper), states that the barometer at 5.30 p. m. of the 26th fell to 27.65 (702.3), which is probably unprecedented. Immense damage was done to shipping on the coasts and to property in the north of Ireland; all telegraph lines were prostrated and many persons were injured. The storm raged throughout the British Isles and western Europe during the 27th, and until the 28th.

XI.—The circulation of the winds between W. 30° and 40° and N. 45° and 50°, on the 28th, showed the development of a depression in that region. By the 29th the pressure ranged from 29.24 (742.7) to 29.4 (746.7) between N. 47°, W. 38°, and N. 52°, W. 28°, while strong ssw. and sw. gales prevailed. The disturbance moved northeastward beyond the fifty-fifth parallel on the 30th, the pressure on that day being about 29.3 (744.2), wind wsw., force 8, in N. 55°, W. 11°.

XII.—This disturbance appeared near N. 48°, W. 27° to W. 21°, on the 30th, when the pressure ranged from 29.51 (749.5) to 29.6 (751.8), and at the close of the month it was central southwest of Ireland, attended by strong northerly and north-westerly gales to the westward.

OCEAN ICE.

Chart ii. also exhibits the southern and eastern limits of icebergs in the north Atlantic ocean during the month of January, and up to February 14, 1884. This chart is based on reports communicated by shipmasters to this office; reports furnished through the co-operation of the "New York Herald Weather Service," and other data published by the "New York Maritime Register."

During the period embraced in the reports (January 20th to February 14th), icebergs drifted southward to about N. 42° 50', while the eastern limit was on the forty-fifth meridian. The most dangerous region appears to have been from about N. 45° northward to N. 48°, and between W. 46° and 49°.

A comparison with the chart for the same period in 1883 shows that the southern limit is about 1° 40' south of that for last year, while the eastern limit is about the same for both years. In point of numbers the icebergs appear to be somewhat more numerous than those observed up to February 14, 1883; those reported were seen about ten days earlier than last year.

Icebergs and field-ice have been reported as follows:

January 24th.—S. S. "British Prince," in N. 48° 02', W. 47° 43', passed field-ice.

January 26th.—S. S. "Plover," at Saint John's, Newfoundland, reports heavy Arctic ice northeast of Notre Dame Bay; icebergs of vast size being scattered through the field-ice.

January 28th.—S. S. "Somerset," in N. 47° 25', W. 46° 44', passed a quantity of field-ice.

January 31st.—S. S. "City of Montreal," in N. 46° 25', W.

46° 54', passed great quantities of field-ice; steered sw. for four hours to clear it; s. s. "Britannic," in N. 46° 47', W. 46° 46', passed through several patches of field-ice.

February 1st.—S. S. "Holland," in N. 45° 44', W. —° —' passed a quantity of field-ice fifty miles long, bearing sw. and ne., with several small bergs on the se. side.

2d.—S. S. "Notting Hill" collided with an iceberg and was so seriously damaged that she was abandoned on the 5th in N. 46°, W. 46° 20'; s. s. "England," in N. 45° 28', W. 47° 49', passed through a large quantity of field-ice.

3d.—S. S. "Rhaetia," from N. 44° 57', to N. 44° 53', and W. 49° 38' to W. 49° 50', passed large fields of ice and many pieces; s. s. "Westernland," in N. 45° 26', W. 47° 54', passed through large quantities of field-ice; s. s. "Caspian," in N. 47° 10', W. 48° 00', passed south of some field-ice.

4th.—S. S. "Salerno," in N. 44° 23', W. 48° 38', passed some field-ice; s. s. "Kansas," in N. 46° 14', W. 47° 00', passed four icebergs.

5th.—S. S. "State of Nebraska," in N. 46° 15', W. 46° 20', fell in with some detached ice.

6th.—S. S. "Moravia," in N. 44° 30', W. 48° 45', passed an iceberg; s. s. "Republic," in N. 45° 28', W. 48° 20', passed a quantity of small ice; s. s. "Lord Olive," in N. 43° 50', W. 49° 15', saw an ice-floe apparently about fifty or sixty feet long and ten to fifteen feet high.

7th.—S. S. "Habsburg," in N. 44° 45', W. 49° 0', sighted two small icebergs; s. s. "Leerdam," in N. 46° 56', W. 47° 24', passed some icebergs.

8th.—S. S. "Lydian Monarch," in N. 46° 44', W. 45° 50' passed an iceberg.

9th.—S. S. "Rugia," in N. 44° 04', W. 47° 18', to N. 44° 34', W. 48° 50', passed three icebergs; s. s. "Chateau Lafitte," in N. 42° 50', W. 49° 00', passed an iceberg; s. s. "Canada," in N. 45° 20', W. 49° 24', passed an iceberg; s. s. "Ludgate Hill," in N. 45° 38', W. 47° 25', passed a large iceberg.

10th.—S. S. "Nevada," in N. 46° 22', W. 47° 33', passed several large flat bergs and much field-ice.

13th.—S. S. "Switzerland," in N. 45° 45', W. 45° 29', passed within a mile of a large iceberg about five hundred feet long and one hundred feet high.

14th.—S. S. "Switzerland," in N. 44° 34', W. 49° 28', passed through a quantity of light field-ice.

TEMPERATURE OF THE AIR.

[Expressed in degrees, Fahrenheit.]

In the following table are shown the normal temperatures for January, the mean temperatures for January, 1884, and the departures from the normal in the several geographical districts, as deduced from the records of the Signal Service:

Average temperatures for January, 1884.

Districts.	Average for January, Signal-Service observations.		Comparison of Jan., 1884, with the average for several years.
	For several years.	For 1884.	
New England	26.6	24.3	2.3 below.
Middle Atlantic states.....	33.8	30.7	3.1 below.
South Atlantic states.....	47.2	42.9	4.3 below.
Florida peninsula.....	60.5	57.2	3.3 below.
Eastern Gulf states.....	49.4	41.2	8.2 below.
Western Gulf states.....	47.9	40.9	7.0 below.
Rio Grande valley.....	57.9	52.6	5.3 below.
Tennessee.....	40.0	31.8	8.2 below.
Ohio valley.....	33.0	24.8	8.2 below.
Lower lake region.....	25.1	18.7	6.4 below.
Upper lake region.....	19.6	13.0	6.6 below.
Extreme northwest.....	5.1	0.9	4.2 below.
Upper Mississippi valley.....	23.9	17.9	6.0 below.
Missouri valley.....	19.1	16.0	3.1 below.
Northern slope.....	18.0	18.9	0.9 above.
Middle slope.....	28.5	29.3	0.8 above.
Southern slope.....	45.0	39.0	6.0 below.
Southern plateau.....	42.7	43.3	0.6 above.
Northern plateau.....	31.2	31.2	Normal.
North Pacific coast region.....	39.6	38.9	0.7 below.
Middle Pacific coast region.....	47.1	47.6	0.5 above.
South Pacific coast region.....	52.9	54.5	1.6 above.
Mount Washington, N. H.....	5.4	5.2	0.2 below.
Pike's Peak, Colo.....	2.8	2.4	0.4 below.
Salt Lake City, Utah.....	28.3	29.1	0.8 above.

The general distribution of mean temperature and the districts of maximum departures from the normal for the month of January, from 1873 to 1883, inclusive, are as follows:

Districts.	Maximum departures.	Year.	Distribution.
Michigan and northern Ohio... From Wisconsin and Minnesota to Kansas. Lower Mississippi valley and northwestern New York.	+6.0 -7.0 -12 -5.0	1873...	{ Normal in the south Atlantic states; below the normal in all other districts east of the Rocky mountains.
Ohio valley and Tennessee..... Middle Atlantic states..... Lower lake region..... Upper lake region..... New England.....	+6.9 +6.0 +6.2 +5.5 +3.8	1874...	{ Normal in Minnesota; above the normal in all other districts east of the Rocky mountains, the departures being least in the upper Mississippi and Missouri valleys.
Minnesota..... Upper Mississippi valley..... Upper lake region..... Lower Missouri valley..... Lower lake region.....	-13.1 -11.6 -9.7 -9.5 -9.5	1875...	{ Below the normal in all districts east of the Rocky mountains, the departures being least in the south Atlantic and Gulf states.
Ohio valley and Tennessee..... Upper Mississippi valley..... Missouri valley..... Gulf states..... South Atlantic states..... Pacific coast.....	+9.0 +7.7 +6.9 +6.4 +6.4 +1.2	1876...	{ Below the normal on the Pacific coast; above the normal in all districts east of the Rocky mountains, the smallest departures occurring in Minnesota, the Saint Lawrence valley, and New England.
Pacific coast..... Lower lake region..... Middle Atlantic states..... Saint Lawrence valley..... Upper lake region.....	+3.5 -5.8 -5.4 -4.6 -3.5	1877...	{ Above the normal on the Pacific coast; below the normal in the districts east of the Rocky mountains, the departures in the Ohio valley, south Atlantic and Gulf states being less than 1°.
Minnesota..... Upper Mississippi valley..... Upper Missouri valley..... Lower Missouri valley..... Gulf states..... South Atlantic states.....	+13.3 +12.3 +10.0 +7.8 +1.0 -0.8	1878...	{ Above the normal on the Pacific coast and in all districts eastward, except slightly below at the Rocky mountain stations and in the south Atlantic and Gulf states.
Lower Missouri valley..... Rio Grande valley..... Canadian maritime stations... Middle Atlantic states..... Lower lake region..... Florida peninsula.....	+1.9 +1.0 +1.0 -2.8 -2.6 -2.4	1879...	{ Normal in the south Atlantic states, upper lake region, Minnesota, upper Mississippi valley, northern and southern slopes, at Salt Lake City, Utah, and Tucson, Arizona; above the normal in the lower Missouri and Rio Grande valleys and at the Canadian maritime stations; below the normal in all other districts.
Upper Mississippi valley..... Ohio valley and Tennessee..... South Atlantic states..... Western Gulf states..... Sacramento..... San Francisco.....	+15.5 +14.8 +13.3 +13.3 +7.4 -4.3	1880...	{ Below the normal in California, and at Olympia, Washington Territory; decidedly above the normal in the northern plateau and in all districts east of the Rocky mountains.
Middle Pacific coast..... Salt Lake City, Utah..... Missouri valley..... Southern slope..... Upper Mississippi valley..... Western Gulf states.....	+3.5 +3.5 +9.8 +8.9 +8.2 +7.6	1881...	{ Above the normal in the north and middle Pacific coast regions, and at Salt Lake City, Utah; below the normal in all other parts of the country, the departures being less than 1° in Florida and in the northern plateau.
Missouri valley..... Western Gulf states..... Florida peninsula..... Middle plateau..... Northern plateau..... South Pacific coast.....	+8.6 +5.1 +4.9 +4.6 +3.2 +3.2	1882...	{ Below the normal on the Pacific coast and in the plateau districts; above the normal in all districts east of the Rocky mountains, except 0.2 below in New England.
Florida peninsula..... South Pacific coast..... Extreme northwest..... Upper Mississippi valley..... Missouri valley..... Upper lake region.....	+2.4 +0.7 -11.5 -11.3 -9.0 -7.9	1883...	{ Above the normal in Florida and in southern California; below the normal in all other districts, the departures being less than 1° in the south Atlantic and eastern Gulf states and southern plateau.

The distribution of mean temperature over the United States and Canada for January, 1884, is exhibited on chart iii. by the dotted isothermal lines.

The month of January, 1884, was slightly warmer than the average in California, in the northern and middle slopes, and in the middle and southern plateau districts. A comparison of the mean temperatures for January in those districts with the normal shows departures of from 0°5 to 0°9, except in southern California, where it amounted to 1°6. The mean temperature for the northern plateau does not differ from the normal for that district. In the north Pacific coast region, and in all districts east of the Rocky mountains, excepting the northern and middle slopes, the mean temperature of the month has been below the average. A marked deficiency of 8°2 occurred in the Ohio valley, Tennessee, and the eastern Gulf states. In the lake region, upper Mississippi valley, west

Gulf states, and southern slope, the deficiencies ranged from 6° to 7°. In the other districts east of the Rocky mountains where deficiencies occurred, they varied from 2°3 in New England to 5°3 in the Rio Grande valley.

DEVIATIONS FROM MEAN TEMPERATURE.

The departures exhibited by the reports from the regular Signal Service stations are shown in the table of average temperatures for January, 1884. The following notes in connection with this subject are reported by voluntary observers.

Alabama.—Green Springs, Hale county: mean temperature, 37°6, is 9° below the mean of January, 1883, and is the lowest monthly mean that has occurred during the last ten years.

Arkansas.—Lead Hill, Boone county: mean temperature, 28°5, is 8°1 below the January average of the last two years.

Georgia.—Forsyth, Monroe county: mean temperature, 40°8, is, with the exception of 39°8 for December, 1876, the lowest monthly mean temperature that has occurred during the last ten years.

Illinois.—Anna, Union county: mean temperature, 25°6, is 7°2 below the January average of nine years. The temperature extremes, the monthly means, and the highest and lowest daily means for two of the coldest months of which there is a record, are:

January, 1864.	January, 1884.
Highest temperature..... 67	Highest temperature..... 65
Lowest temperature..... -22	Lowest temperature..... -21
Monthly mean temperature..... 32.2	Monthly mean temperature..... 25.6
Highest daily mean temperature..... 58.5	Highest daily mean temperature..... 60.0
Lowest daily mean temperature..... -11.7	Lowest daily mean temperature..... -15.0

Riley, McHenry county: mean temperature, 9°8, is 8° below the January average of the last twenty-one years, and is, with the exception of that for January, 1875, the lowest for the period named.

Mattoon, Coles county: mean temperature, 21°, is 5° below the January average of the last five years.

Indiana.—Wabash, Wabash county: mean temperature, 18°7, is 6°7 below the January average of eight years.

Logansport, Cass county: mean temperature, 18°6, is 11°3 below the January average of the last twenty-five years.

Laconia, Harrison county: mean temperature, 23°0, is the lowest January mean of which there is a record.

Kansas.—Independence, Montgomery county: mean temperature, 22°0, is 7°2 below the January average of thirteen years.

Lawrence, Douglas county: mean temperature, 20°99, is 5°65 below the January average of the last seventeen years.

Wellington, Sumner county: mean temperature, 23°9, is 3°4 below the January average of the four preceding years.

Yates Centre, Woodson county: mean temperature, 19°5, is 6°1 below the average of the four preceding years.

Kentucky.—Bowling Green, Warren county: mean temperature, 26°4, is the lowest monthly mean ever recorded.

Maryland.—Fallston, Harford county: mean temperature, 26°1, is 4°2 below the average of the last thirteen years.

Massachusetts.—Westborough, Worcester county: mean temperature, 22°4, is 2°5 below the average of the last five years.

Mr. J. B. Hall, of Worcester, Massachusetts, reports the normal mean temperature of January for a period of forty-five years to be 29°6 (?), and the mean for January to be 20°4, or 9°2 (?) below the normal. During the period above named the lowest January mean temperature, 16°7, occurred in 1856; and the highest, 34°9, occurred in 1880.

Missouri.—Saint Louis: Professor Nipher, director of the "Missouri Weather Service," reports as follows:

January has been unusually cold * * *. The average temperature at the central station was 22°3, which is 9°1 below the normal January temperature for Saint Louis, as shown by Dr. Engelmann's series for forty-nine years. The average January temperature was, however, lower than the mean for January, 1884, in the following years, viz: 20°2 in 1856, 19°3 in 1857; and 21°3 in 1875.

New Hampshire.—Contoocookville, Merrimac county: mean

temperature, 19° 1 is 2° below the January average of a period of twelve years.

New Jersey.—South Orange, Essex county: mean temperature, 23° 8, is the lowest January mean of the last fourteen years.

New York.—Palermo, Oswego county: mean temperature, 14° 1, is 7° 5 below the January average of the last thirty-one years. The highest January mean of that period, 29° 4, occurred in 1880; the lowest, 12° 8, occurred in 1881.

North Volney, Oswego county: mean temperature, 16° 8, is 5° 2 below the January average of sixteen years.

North Carolina.—Highlands, Macon county: January, 1884, was a remarkably cold month; mean temperature, 26° 8.

Ohio.—Wauseon, Fulton county: mean temperature, 14° 5, is 9° 5 below the January average of the last fourteen years. The highest January mean of that period, 37° 7, occurred in 1880; the lowest, 12° 2, in 1875. The temperature extremes

are: maximum, 69° 5, in 1876; minimum, -31° 7, January 25, 1884.

Texas.—New Ulm, Austin county: mean temperature, 44° 04, is 6° 83 below the January mean of the last twelve years. The highest January mean of that period, 63° 7, occurred in 1879; the lowest, 43° 17, in 1880. The temperature extremes are: maximum, 84°, in 1880; minimum, 10°, in 1873.

Vermont.—Woodstock, Windsor county: mean temperature, 11° 15, is 3° 72 below the January average of the last seventeen years. The highest January mean of that period, 23° 77, occurred in 1880; the lowest, 5° 82, in 1875. The temperature extremes are: maximum, 62°, in 1876; minimum, -38°, in 1873 and 1878.

Virginia.—Variety Mills, Nelson county: mean temperature, 30° 5, is 5° below the January average of the last seven years, and is the lowest for that period. The minimum temperature of the 7th, -8° 5, is the lowest recorded since 1881.

Table of comparative minimum temperatures for the month of January.

State or Territory.	Minimum for January, 1884, Signal Service.		Minimum since Signal-Service stations were opened—3 to 13 years.			Lowest from any other source.			
	Station.	Temp.	Station.	Temp.	Year.	Place.	Temp.	Year.	Length of Record.
Alabama	Montgomery	0	Montgomery	0	73, '79	Huntsville	0	1832, '36	9 years.
Arizona	Fort Bowie	1	Prescott	-14	1880	Fort Canby (old)	-20	1886	12 "
Arkansas	Fort Smith	-5	Fort Smith	-2	1883	Mount Ida	-10	1878	6 "
California	Red Bluff	30	Campo	0	1880	Fort Crook	-20	1859	11 "
Colorado	Pike's Peak	-33	Pike's Peak	-37	1883	Fort Garland	-40	1873	30 "
Do	West Las Animas	-10	Denver	-29	1875	Fort Lyon	-28	1875	22 "
Connecticut	New Haven	4	New Haven	-14	1873	Colebrook	-25	1861	9 "
Do	New London	6	New London	-14	1873	New Haven	-24	1835	87 "
Dakota	Fort Yates	-45.5	Pembina	-53	1877	Fort Randall	-44	1875	22 "
Do	Fort Buford	-41	Fort Buford	-46	1883	Fort Stevenson	-55	1881	9 "
Delaware	Delaware Breakwater	9	Delaware Breakwater	10	1882	Fort Delaware	-5	1866	44 "
District of Columbia	Washington City	1.7	Washington City	-14	1881	Washington City	-14	1835	48 "
Florida	Pensacola	16	Saint Marks	18	1879	Fort Barrancas	10	1852	61 "
Georgia	Atlanta	-1.3	Atlanta	9	1879	Atlanta	3	1873	4 "
Do	Augusta	14	Augusta	15	1873	Augusta Arsenal	8	1835	48 "
Idaho	Coeur d'Alene	-2	Fort Lapwai	-38	1882	Fort Lapwai	-32	1875	19 "
Illinois	Chicago	-18.5	Chicago	-18	1879	Rock Island Arsenal	-29	1873	14 "
Do	Springfield	-22	Champaign	-15	1881	Galesburg	-29	1864	8 "
Indiana	Indianapolis	-25	Indianapolis	-22	1879	Arlington, near	-25	1879	2 "
Indian Territory	Cantonment	-5	Fort Supply	-17	1881	Fort Gibson	-20	1857	54 "
Do			Fort Gibson	-12	1881	Fort Sill	-20	1873	9 "
Iowa	Des Moines	-30	Dubuque	-26	1883	Fort Madison, near	-33	1864	18 "
Kansas	Leavenworth	-21	Leavenworth	-29	1873	Fort Leavenworth	-30	1834	52 "
Kentucky	Louisville	-19	Louisville	-10	74, '79	Newport Barracks	-15	29	"
Louisiana	Shreveport	10	Shreveport	6	1879	Baton Rouge	8	1852	2 "
Do	New Orleans	22	New Orleans	20	1879	Okaloosa	5	1879	3 "
Maine	Eastport	-8	Eastport	-20	1874	Brunswick	-32	1859	52 "
Do	Portland	-5	Portland	-11.5	1882	Gardiner	-32	1878	41 "
Maryland	Baltimore	6	Baltimore	-6	1881	Fort McHenry	-15	1873	53 "
Massachusetts	Boston	-0.5	Springfield	-14	1881	Williamstown	-30	1835	55 "
Michigan	Marquette	-19	Escanaba	-28	1873	Fort Brady	-42	1873	60 "
Do	Alpena	-20	Alpena	-27	1882	Ontonagon	-34	1861	11 "
Minnesota	Saint Vincent	-41	Saint Vincent	-44	81, '82	Fort Ripley	-44	1860	17 "
Do	Moorhead	-43	Moorhead	-42	1882	Minneapolis	-40	1868	6 "
Mississippi	Vicksburg	10	Vicksburg	10	1875	Fayette	7	1879	9 "
Missouri	Saint Louis	-21.5	Saint Louis	-16	1875	Ashley	-27	1879	4 "
Do						Saint Louis	-19	1835	40 "
Montana	Fort Benton	-24	Fort Benton	-55	1875	Fort Benton	-58	1875	13 "
Do	Poplar River	-48	Virginia City	-44	1875	Fort Ellis	-53	1872	15 "
Nebraska	North Platte	-9	North Platte	-27	1881	Camp Sheridan	-30	1881	5 "
Do	Omaha	-38	Omaha	-22	1879	Fort Niobrara	-35	1881	1 "
Nevada			Pioche	-17	1882	Fort Ruby	-23	1864	5 "
Do			Winnemucca	-14	1879	Fort Halleck	-22	1868	13 "
New Hampshire	Mount Washington	-29	Mount Washington	-46	1875	Dartmouth College	-14	1848	17 "
New Jersey	Barnegat City	8	Barnegat City	-10	1875	Paterson	-13	1866	10 "
Do	Atlantic City	4	Squad Beach	-10	1875	Atco	-24	1881	7 "
Do	Sandy Hook	8	Sandy Hook	-3	1879	Burnt Mills	-24	1875	3 "
New Mexico	Fort Stanton	-2	Santa Fe	-13	1882	Fort Union	-25	1881	31 "
New York	Albany	-4	Albany	-18	1878	Salem	-40	1840	8 "
Do	Buffalo	-13.5	Oswego	-13	1883	Gouverneur	-38	1835	40 "
North Carolina	Charlotte	5	Charlotte	11	79, '81	Murphy	-16	1877	8 "
Do	New River Inlet	4	Kitty Hawk	11	1879	Lenoir	-16	1877	7 "
Ohio	Columbus	-20	Columbus	-20	1879	Westerville	-24	1877	8 "
Do	Toledo	-14	Sandusky	-16.5	1879	Jacksonburg	-25	1879	8 "
Oregon	Fort Klamath	-9	Umatilla	-25	1879	Fort Dalles	-23	1862	16 "
Pennsylvania	Pittsburg	-6	Pittsburg	-12	1875	Carlisle Barracks	-28	1873	37 "
Do	Erie	-10	Philadelphia	-5	1875	Philadelphia	-9	1866	111 "
Rhode Island	Point Judith	3	Newport	-8	1882	Providence	-17	1866	35 "
Do	Narragansett Pier	2	New Shoreham	-4	1882	Fort Adams	-13	1873	41 "
South Carolina	Charleston	13	Charleston	19	1873	Spartanburg	0	1877	3 "
Do						Charleston	16	1852	108 "
Tennessee	Knoxville	-16	Knoxville	-14	1877	Clarksville	-10	1879	8 "
Do	Nashville	-10	Nashville	-8	1877	Glenwood Cottage	-8	1864	10 "
Texas	Fort Elliott	0.7	Fort Elliott	-12	1883	Fort Davis	-15	1873	28 "
Utah	Salt Lake City	2	Salt Lake City	0	74, '82	Coalville	-30	75, '77	8 "
Vermont	Lynchburg	2	Burlington	-25	1882	Woodstock	-38	1878	8 "
Do	Dayton	-1.5	Fort Myer	-8	1881	Mount Solon	-18	1881	7 "
Washington Territory			Spokane Falls	-28	1883	Fort Colville	-33	1875	20 "
West Virginia			Morgantown	-6	1875	Helvetia	-14	1879	7 "
Wisconsin			La Crosse	-43	1873	Embarras	-40	1875	19 "
Wyoming	Cheyenne	-11	Cheyenne	-36	1875	Fort Laramie	-40	1864	29 "
Do						Fort Sanders	-61	1875	13 "

Table of maximum and minimum temperatures for January, 1884.

State or Territory.	Signal Service.			U. S. Army Post Surgeons, or Voluntary Observers.		
	Station.	Max.	Min.	Station.	Max.	Min.
Alabama.....	Montgomery.....	79	9	Auburn.....	67	3
Do.....	Mobile.....	67	14	Mt. Vernon Bar'ks.....	74	10
Arizona.....	Willcox.....	80	2	Pantano.....	83	34
Do.....	Fort Bowie.....	68	1	Willcox.....	72	10
Arkansas.....	Little Rock.....	72	6	Fayetteville.....	67	-19
Do.....	Fort Smith.....	69	-5	Mount Ida.....	72	2
California.....	Los Angeles.....	75	34	Mojave.....	86	20
Do.....	Red Bluff.....	67	30	Summit.....	35	16
Colorado.....	West Las Animas.....	68	-10	Gunnison.....	31	-30
Do.....	Pike's Peak.....	22	-33	Fort Lyon.....	66	-7
Connecticut.....	New London.....	52	6	Voluntown.....	50	-4
Do.....	New Haven.....	50	4	Southington.....	49	-9
Dakota.....	Deadwood.....	59	-14.5	Fort Lincoln.....	40	-45
Do.....	Fort Yates.....	45	-45.5	Fort Sully.....	52	-30
Delaware.....	Del. Breakwater.....	53	9			
District of Columbia.....	Washington City.....	52	1.7	Rock Creek Bridge.....	49	6
Florida.....	Sanford.....	82	35	Limona.....	82	28
Do.....	Pensacola.....	71	16	Fort Barrancas.....	74	19
Georgia.....	Augusta.....	68	14	Forsyth.....	72	6
Do.....	Atlanta.....	64	-1.5	Andersonville.....	70	12
Idaho.....	Lewiston.....	54	11	Fort Lapwai.....	47	4
Do.....	Coeur d'Alene.....	50	2			
Illinois.....	Cairo.....	66	-16	Anna.....	65	-21
Do.....	Springfield.....	62	-22	Riley.....	40	-31
Indiana.....	Indianapolis.....	57	-25	Marion.....	62	-16
Do.....				Lafayette.....	55	-28
Indian Territory.....	Cantonment.....	-5		Fort Reno.....	69	-4
Iowa.....	Keokuk.....	52	-24	Guttenberg.....	42	-35
Do.....	Des Moines.....	49	-30	Des Moines.....	50	-31
Kansas.....	Leavenworth.....	57	-21	West Leavenworth.....	55	-26
Do.....	Dodge City.....	66	-11	Fort Scott.....	58	-24
Kentucky.....	Louisville.....	62	-19.5	Frankfort.....	58	-20
Do.....				Bowling Green.....	63	-8
Louisiana.....	Shreveport.....	73	10	Luling.....	75	18
Do.....	New Orleans.....	72	22	Liberty Hill.....	71	15
Maine.....	Portland.....	45	-3	Fort Preble.....	45	13
Do.....	Eastport.....	45	-8	Orono.....	43	-3
Maryland.....	Baltimore.....	52	8	Cumberland.....	54	-29
Do.....	Ocean City.....	52	4	Woodstock.....	45	2
Massachusetts.....	Boston.....	52	-0.5	Taunton.....	51	3
Do.....	Thatcher's Island.....	45	3	Rowe.....	45	-15
Michigan.....	Detroit.....	52	9	Fort Brady.....	36	-32
Do.....	Alpena.....	49	-20	Ann Arbor.....	51	-17
Minnesota.....	Saint Paul.....	45	-32	Chester.....	39	-38
Do.....	Moorhead.....	42	-43	Fort Snelling.....	43	-33
Mississippi.....	Vicksburg.....	73	10			
Missouri.....	Saint Louis.....	67	-21.5	Saint Louis.....	69	-23
Do.....				Sedalia.....	50	-33
Montana.....	Fort Shaw.....	51	-15	Fort Shaw.....	51	-15
Do.....	Poplar River.....	45	-48	Fort Keogh.....	45	-32
Nebraska.....	North Platte.....	49	-9	Stella.....	55	-26
Do.....	Omaha.....	47	-32	Nebraska City.....	-30	
Nevada.....				Wadsworth.....	58	8
Do.....				Hallock.....	40	-35
New Hampshire.....	Mount Washington.....	36	-29	Contoocookville.....	48	-12
New Jersey.....	Barnegat City.....	52	7	Vineland.....	50	-8
Do.....	Atlantic City.....	50	4	Newark.....	54	9
New Mexico.....	Fort Craig.....	62	8	Fort Union.....	65	-13
Do.....	Fort Stanton.....	65	-2	Fort Wingate.....	51	7
New York.....	Albany.....	50	-4	Fort Hamilton.....	50	-2
Do.....	Oswego.....	47	-10.5	Madison Barracks.....	41	-29
North Carolina.....	Hatteras.....	68	15	Highlands.....	50	-5
Do.....	New River Inlet.....	66	4	Raleigh.....	63	2
Ohio.....	Cincinnati.....	60	-10	Portsmouth.....	58	-16
Do.....	Columbus.....	45	-20	Wauseon.....	50	-32
Oregon.....	Roseburg.....	63	25	Albany.....	59	24
Do.....	Fort Klamath.....	51	-9	Fort Klamath.....	45	-5
Pennsylvania.....	Philadelphia.....	55	10	Leetsdale.....	52	-12
Do.....	Erie.....	48	-10	Wellsborough.....	42	-24
Rhode Island.....	Block Island.....	54	8			
Do.....	Narragansett Pier.....	45	2	Aiken.....	69	8
South Carolina.....	Charleston.....	70	13	Darnall.....	74	-14
Tennessee.....	Memphis.....	71	-2	Beech Grove.....	61	-14
Do.....	Knoxville.....	59	-16	New Elm.....	78	12
Texas.....	Rio Grande City.....	85	21	Cleburne.....	72	1
Do.....	Fort Elliott.....	73	1	Ogden.....	52	-6
Utah.....	Salt Lake City.....	52	2	Logan.....	48	-13
Do.....				Newport.....	48	-29
Vermont.....				Woodstock.....	45	-36
Do.....				Fort Monroe.....	63	3
Virginia.....	Cape Henry.....	68	12	Variety Mills.....	50	-8.5
Do.....	Lynchburg.....	52	2	Fort Townsend.....	57	25
Washington Territory.....	Neah Bay.....	59	35	Fort Spokane.....	51	-5
Do.....	Dayton.....	57	-1.5	Helvetia.....	58	-7
West Virginia.....				Embarrass.....	46	-35
Wisconsin.....	La Crosse.....	45	-29	Neillsville.....	36	-36
Do.....	Milwaukee.....	45	-24	Fort Bridger.....	44	-15
Wyoming.....	Cheyenne.....	50	-11			

Wytheville, Wythe county: mean temperature, 29°.2, is 6° below the January average of a period of nineteen years, and is the lowest for that period.

Wisconsin.—Manitowoc, Manitowoc county: mean temperature, 13°.2, is 2°.5 below the January average of the last thirty-two years. The highest January mean of that period, 33°.0, occurred in 1880; the lowest, 8°.4, in 1875.

Beloit, Rock county: mean temperature, 10°.2, is the lowest

monthly mean that has occurred since 1850, with the exception of January, 1856, '57, '75, '81, and '83.

Sussex, Waukesha county: mean temperature, 10°.2, is much below the January average.

MONTHLY RANGES OF TEMPERATURE.

The monthly ranges of temperature were greatest in the extreme northwest and over the lower Ohio and central Mississippi valleys. In the extreme northwest they varied from 77° to 93°, and in the Ohio and central Mississippi valleys from 82° to 88°. The monthly ranges were least on the Pacific coast.

Stations reporting monthly ranges of 75° or more, are as follows: Poplar river, Montana, 93°; Fort Yates, Dakota, 90°; Saint Louis, Missouri, 88°; Fort Buford, Dakota, 87°; Springfield, Illinois, 85°; Moorhead, Minnesota, 85°; Bismarck and Huron, Dakota, 82°; Cairo, Illinois, 82°; Indianapolis, Indiana, 82°; Louisville, Kentucky, 82°; Fort Bennett, Dakota, 80°; West Las Animas, Colorado, 79°; Omaha, Nebraska, 79°; Des Moines, Iowa, 79°; Yankton, Dakota, 78°; Dodge City, Kansas, 78°; Leavenworth, Kansas, 78°; Saint Vincent, Minnesota, 77°; Keokuk, Iowa, 77°; Duluth and Saint Paul, Minnesota, 76°; Nashville, Tennessee, 76°; Knoxville, Tennessee, 75°.

Monthly ranges of 40° or less were reported by the following stations: Linkville, Oregon, 40°; San Diego, California, 39°; Provincetown, Massachusetts, 39°; New York City, 39°; Roseburg, Oregon, 38°; Red Bluff, California, 37°; Yuma, Arizona, 35°; Portland, Oregon, 34°; Sacramento, California, 30°; Key West, Florida, 30°; Cape Mendocino, California, 25°; Neah Bay, Washington Territory, 24°; Fort Canby, Washington Territory, 23°; Port Angeles, Washington Territory, 19°; San Francisco, California, 16°.

GREATEST DAILY RANGES OF TEMPERATURE.

The greatest daily ranges of temperature varied in the several districts as follows:

New England.—From 22° at Provincetown, Massachusetts, on the 8th, 13th, and 22d, to 32° at New Haven and New London, Connecticut, on the 8th.

Middle Atlantic states.—From 23° at New York City, on the 8th, Sandy Hook, New Jersey, on the 9th, and at Delaware Breakwater, Delaware, on the 22d, to 36° at Washington City, District of Columbia, on the 8th.

South Atlantic states.—From 24° at Savannah, Georgia, on the 10th, to 38° at Fort Macon, North Carolina, on the 5th.

Florida peninsula.—From 15° at Key West, on the 23d, to 29° at Sanford, on the 7th.

Eastern Gulf states.—From 27° at New Orleans, Louisiana, on the 7th, to 35° at Montgomery, Alabama, on the 5th.

Western Gulf states.—From 30° at Indianola, Texas, and Shreveport, Louisiana, on the 5th and 9th, respectively, to 39° at Fort Smith, Arkansas, on the 9th.

Rio Grande valley.—From 36° at Brownsville, Texas, on the 6th, to 44° at Rio Grande City, Texas, on the 3d.

Tennessee.—From 27° at Memphis, on the 9th, to 35° at Nashville, on the 12th.

Ohio valley.—From 24° at Indianapolis, Indiana, on the 22d, to 29° at Columbus, Ohio, on the 26th.

Lower lake region.—From 26° at Buffalo, New York, on the 13th, and at Sandusky, Ohio, and Detroit, Michigan, on the 23d, to 30° at Cleveland, Ohio, and Oswego, New York, on the 13th and 14th, respectively.

Upper lake region.—From 25° at Chicago, Illinois, on the 21st, to 56° at Marquette, Michigan, on the 17th.

Extreme northwest.—From 41° at Fort Buford, Dakota, on the 13th, to 51° at Saint Vincent, Minnesota, on the 17th.

Upper Mississippi valley.—From 29° at Cairo, Illinois, on the 4th, to 42° at Des Moines, Iowa, on the 23d.

Northern slope.—From 38° at Helena, Montana, on the 30th, to 48° at Fort Shaw, Montana, on the 7th.

Middle slope.—From 27° on the summit of Pike's Peak, Colorado, on the 2d, to 48° at West Las Animas, Colorado, on the 8th and 12th.

Southern slope.—From 44° at Fort Concho, Texas, on the 8th, to 52° at Fort Stockton, Texas, on the 6th.

Southern plateau.—From 27° at Fort Grant, Arizona, on the 12th, to 46° at El Paso, Texas, on the 9th.

Middle plateau.—24° at Salt Lake City, Utah, on the 25th.

Northern plateau.—From 20° at Lewiston, Idaho, on the 31st, to 25° at Spokane Falls and Dayton, Washington Territory, on the 21st and 31st, respectively.

North Pacific coast region.—From 15° at Fort Canby, Washington Territory on the 15th, to 19° at Portland and Roseburg, Oregon, on the 11th and 12th, respectively.

Middle Pacific coast region.—From 13° at San Francisco, California, on the 14th, to 29° at Sacramento, California, on the 22d.

South Pacific coast region.—From 31° at San Diego, California, on the 23d, to 37° at Los Angeles, California, on the 12th.

The following are some of the highest and lowest monthly mean temperatures reported from the Signal Service stations:

Stations reporting highest.	Stations reporting lowest.
Key West, Florida..... 68.3	Saint Vincent, Minnesota..... -7.9
Sanford, Florida..... 55.6	Moorhead, Minnesota..... -3.5
San Diego, California..... 55.0	Pike's Peak, Colorado..... 2.4
Yuma, Arizona..... 54.6	Fort Yates, Dakota..... 4.1
Los Angeles, California..... 53.9	Bismarck, Dakota..... 4.2
Brownsville, Texas..... 53.7	Mount Washington, New Hampshire..... 5.2
Rio Grande City, Texas..... 52.1	Duluth, Minnesota..... 5.3
Cedar Keys, Florida..... 51.6	Fort Buford, Dakota..... 6.3
Phoenix, Arizona..... 50.6	Saint Paul, Minnesota..... 7.9
Fort McDowell, Arizona..... 50.4	Escanaba, Michigan..... 8.6
New Orleans, Louisiana..... 47.1	Huron, Dakota..... 8.9
Galveston, Texas..... 46.7	Marquette, Michigan..... 10.9
Indianola, Texas..... 46.7	Fort Bennett, Dakota..... 12.2

LOW TEMPERATURES.

The minimum temperatures produced by high area number iii. in Montana, Dakota, and Minnesota on the 4th, and during the 5th and 6th over the central valleys and Southern states, were, generally, the lowest recorded since the establishment of the Signal Service stations. Over northeastern Montana and the northern parts of Dakota and Minnesota the minimum temperatures were -40° and below, on the morning of the 4th. Very low temperatures also occurred on the 24th, 25th, and 26th, during the passage of high area number vii., in the lake region, where, at the most northerly stations, they were lower than those which occurred in connection with the high area previously mentioned.

The following reports of remarkably low temperatures have been received from the several states and territories.

Alabama.—Montgomery: very cold weather prevailed on the 5th and 6th. On the latter date the thermometer recorded a minimum temperature of 8°, which is the lowest that has occurred since December 30, 1880, when the same temperature was recorded. These are the lowest temperatures of the last ten years.

Mobile: the minimum temperature of the 6th, 14°, is the lowest recorded since the opening of the signal office, in 1871. A minimum temperature of 14° was recorded on December 30, 1880.

Green Springs, Hale county: the temperature at 2 a. m. of the 6th was -4°, and at 7 a. m., it was 4°. These are the lowest temperatures recorded for several years.

Arkansas.—Little Rock: very cold weather on the 5th and 6th; on the morning of the 6th a minimum temperature of 5° was recorded at the signal office; several instruments in different parts of the city indicated a temperature of -3°.

Lead Hill, Boone county: much suffering was caused by the extremely cold weather of the 5th. The minimum temperature of that date was -15°.

Dakota.—Huron: on the 3d the maximum temperature was -4°; minimum, -22°. On the 4th the temperature fell to -38°, which is said to be the lowest ever recorded. On that date the temperature did not rise above -26°. A minimum temperature of -38° was also recorded on the 5th.

Bismarck: the 4th was the coldest day experienced for many

years; mean temperature for the day, -34°; minimum, -40°.

Vermillion, Clay county: the night of the 4-5th was extremely cold; the temperature fell to -34°.

Florida.—Jacksonville: freezing weather prevailed on the 6th; the temperature fell to 21°.

Pensacola: the weather was remarkably cold on the 6th; the minimum temperature during the morning was 16°, which is the lowest on the records of the signal office.

Georgia.—Atlanta: the temperature fell to -1° on the morning of the 6th, which is the lowest on the records of the signal office. Much suffering resulted from the cold weather.

Augusta: the lowest temperature of the season, 14°, occurred on the morning of the 6th.

Forsyth, Monroe county: the daily mean temperatures of the 5th and 6th were 21° and 22°, respectively. These are probably the lowest daily means that have occurred since 1835, with the exception of December 29 and 30, 1880. The effect of this cold weather was very damaging to agricultural interests. The mild season previous to January 1st was most favorable to vegetation. A large acreage of oats was seeded and the crop was in excellent condition, but from present appearances the crop has been almost entirely destroyed.

Illinois.—Olney, Richland county: on the morning of the 5th thermometers registered temperatures of -28° and -30°, which are the lowest temperatures ever experienced.

Cairo: the minimum temperature on the 5th, -16°, is the lowest on the records of the signal office. The mean temperature for the day was -9°.

Springfield: the 5th was the coldest day experienced for several years; the average temperature for the day was -16°; maximum, -11°, and minimum, -22°.

Rockford, Winnebago county: the temperature on the 4th, -40°, is the lowest known for forty years.

Chicago: minimum temperature on the 5th, -18°, has been exceeded only once since 1871, viz: -20° in 1875.

Marshall, Clark county: the night of the 4-5th was the coldest ever known; at 2 a. m. the thermometer read -30°.

Peoria, Peoria county: the temperature on the morning of the 5th fell to -27°, which is the lowest recorded during the last twenty-nine years.

Edgington, Rock Island county: the weather on the 3d, 4th and 5th was the coldest experienced since 1856. The thermometer indicated -34° on the morning of the 5th. Many persons were frost-bitten.

Riley, McHenry county: the minimum temperature, -30°, on the morning of the 5th, was the lowest that has occurred during the last twenty-one years. The mean for that date, -23°, is, with the exception of that for January 1, 1864, the lowest daily mean recorded during the last twenty-one years.

Collinsville, Madison county: the minimum temperature of the 5th, -23°, was the lowest recorded since January 1, 1864.

Indiana.—New Albany, Floyd county: the 5th was the coldest day that has been experienced for thirty-five years. At 6 a. m. the temperature was -23°, at noon, -10°, and at 7 p. m., -12°.

Vincennes, Knox county: the temperature during the early morning of the 5th was -30°, and at sunrise, -28°; it remained below zero all day, and at night fell to -20°.

Rising Sun, Ohio county: during the morning of the 5th the temperature was -22°, and at noon, -4°.

Shelbyville, Shelby county: the minimum temperature of the 5th was -26°, and the maximum, -6°. The following are the lowest temperatures recorded since 1842, as shown by the meteorological record of Dr. Milton Robins:

Year.	Month.	Minimum temperature.	Year.	Month.	Minimum temperature.
1851.....	December 17.....	-28	1856.....	February 4.....	-30
1852.....	January 19.....	-26	1873.....	January 29.....	-27
1852.....	January 20.....	-28	1877.....	January 9.....	-26

Indianapolis: on the 5th the temperature remained below zero all day. The minimum temperature of that date, -25° , is the lowest that has been recorded since the establishment of the signal office, in 1871. The temperature did not rise above zero on the 6th, the minimum being -20° .

Logansport, Cass county: the minimum temperature, -24° , on the 5th, is, with the exception of -30° in 1873, the lowest recorded during the last twenty-five years.

Vevay, Switzerland county: Professor Bœrner reports that the minimum temperature (-23°) on the morning of the 5th is the lowest ever recorded. Observers in surrounding localities reported temperatures ranging from -21° to -27° .

Sunman, Ripley county: on the morning of the 5th the thermometer indicated a temperature of -24° , which is the lowest recorded for the last thirty years.

Iowa.—Sioux City, Woodbury county: the temperature at 1 p. m. of the 4th was -21° .

Council Bluffs, Pottawattomie county: at 10 p. m. of the 4th the thermometer read -24° , which is the lowest observed for twenty-five years.

Dubuque: intensely cold weather prevailed on the 3d, 4th, and 5th. On the last date the temperature fell to -24° , and the mean for the day was $-14^{\circ}2$.

Burlington: during the early morning of the 5th the temperature fell to -33° .

Des Moines: on the a. m. of the 5th the temperature fell to $-30^{\circ}4$, which is the lowest recorded here for many years. It did not rise above -7° during the 4th, and remained below zero throughout the 5th, the daily means for the 4th and 5th being $-18^{\circ}0$ and $-13^{\circ}7$, respectively.

Fort Madison, Lee county: the weather on the 5th was the coldest ever experienced. On that morning the thermometer read -30° . Records covering a period from 1848 to 1884 show that the temperature had never before fallen below -25° .

Humboldt, Humboldt county: at 2 p. m. of the 4th the thermometer indicated -27° and on the morning of the 5th it read -33° , which are the lowest temperatures ever recorded.

Kansas.—Independence, Montgomery county: the thermometer read -20° on the a. m. of the 5th, which is the lowest ever recorded.

Fort Scott, Bourbon county: on the morning of the 5th a temperature of -24° was recorded, which is the lowest ever known. A car load of mules were frozen to death a few miles east.

Leavenworth: the temperature on the 5th ranged from -4° to -21° .

Kentucky.—Louisville: at the morning observation of the 5th the minimum thermometer indicated a temperature of -18° , while the exposed standard read -15° ; a little later the minimum thermometer recorded $-19^{\circ}5$. At 3 p. m. the temperature had risen to -3° , and fell again to -14° during the evening. The daily means for the 5th and 6th were $-9^{\circ}3$ and $-1^{\circ}2$, respectively. This is the coldest weather ever experienced. The lowest temperature previously recorded since the establishment of the signal office in 1871 is -10° , for Januarys of 1875 and 1879.

Cynthiana, Harrison county: at 5 a. m. of the 5th the thermometer read -22° .

Maine.—Bangor: authentic reports from Aroostook county state that on the morning of the 28th the temperature fell to -40° , which is the lowest ever recorded.

Michigan.—Alpena: the temperature remained below zero all day on the 5th; at 10.34 p. m. it was -16° , and at midnight, -20° . During the 24th the temperature did not rise above $-3^{\circ}5$.

Mackinaw City: on the 24th the thermometer did not rise above $-3^{\circ}5$, and the minimum was $-15^{\circ}9$. This was the coldest weather experienced since the opening of this station.

Port Huron: the minimum temperature on the morning of the 25th, $-11^{\circ}3$, is the lowest of the season.

Grand Haven: the steamer "Wisconsin," which left port at 7 p. m. of the 2d for Milwaukee, arrived at that place at noon

of the 4th. Captain McGregor states that great suffering was experienced by the crew from the extremely cold weather, the thermometer registering from -14° to -17° . The lowest temperature ($-8^{\circ}5$) of the season at Grand Haven was recorded on the 24th. Thermometers exposed near the ground in various parts of the city indicated a temperature of -14° .

Cheboygan, Cheboygan county: the thermometer indicated -30° at 2 a. m. of the 25th, which is the lowest observed for many years.

Grand Rapids, Kent county: thermometers in this vicinity registered from -20° to -30° on the morning of the 24th. The night of the 23d-24th was one of the coldest in this region since February 9, 1875, when the temperature fell to -38° .

Minnesota.—Minneapolis: the thermometer at noon of the 4th read -30° . The temperature on this date was the lowest experienced for twenty-five years.

Mississippi.—Vicksburg: the minimum temperature on the morning of the 6th, $10^{\circ}3$, is, with the exception of 10° on January 6, 1875, the lowest on the records of the signal office.

Missouri.—Pierce City: the temperature at 7 a. m. of the 5th was -22° ; at 2 p. m., -4° ; 9 p. m., -9° ; daily mean, $-11^{\circ}6$. Mr. J. J. Spilman, voluntary observer, states that that was the coldest day that has occurred since 1847.

Prof. Francis E. Nipher, director of the Missouri Weather Service, reports:

The lowest temperature recorded in Saint Louis was $-23^{\circ}4$, which is half a degree colder than the previously observed minimum in January, 1873. In the state the temperature has fallen still lower. The lowest minimum reported was -33° at Sedalia; Warrensburg and Kirksville reporting -32° ; Boonville and Harrisonville, -31° ; Miami, -30° , and Savannah, -27° . The highest minimum temperatures reported were -16° at Cairo, Illinois, $-23^{\circ}5$ at Saint Louis, and $-24^{\circ}2$ at Keokuk, Iowa.

The following notes on the low temperature of the 5th are given by the observers: Saint Charles, the 5th was the coldest ever observed here; Oregon, coldest since January 18, 1857, when the thermometer registered -30° ; Louisiana, thermometer stood at -33° on the river bridge; Ironton, coldest weather yet observed here, thermometer read -23° , the coldest heretofore was -17° ; Chamois, January, 1875, the thermometer read two degrees lower than in the present month; Clinton, -32° at 7 o'clock; Steelville, on the 5th, -18° . The observer at O'Fallon reports that on January 29, 1873, the thermometer read -28° , and at Trenton, Saint Louis county, on January 1, 1864, his thermometer read -23° .

New York.—New York City: the lowest temperature for January, 1884, was 8° on the 7th, which is considerably above the average January minimum. The coldest day in New York City during the last fifty years, was January 8, 1866, when a minimum temperature of -7° occurred. At the Brooklyn navy-yard and on Bedford avenue, Brooklyn, on the same day, temperatures of -12° and -15° , respectively, were recorded. The next coldest days in New York City were January 10, 1875, and December 30, 1880, when the temperature at the signal office was $-6^{\circ}3$.

Factoryville, Tioga county: temperature on 26th, -21° , is the lowest recorded for several years.

North Carolina.—Kitty Hawk: very cold weather prevailed on the 6th, the temperature falling to $8^{\circ}6$.

New River Inlet: a minimum temperature of 4° occurred on the 6th, which is the lowest observed for many years.

Fort Macon: a minimum temperature of $8^{\circ}5$ occurred on the morning of the 6th, which is the lowest on the records of the signal office, and is believed to be the lowest recorded during the last twenty years.

Charlotte: on the morning of the 6th a temperature of 5° occurred, which is the lowest observed for many years.

Scott's Hill: the 6th was the coldest day ever experienced; the self-registering thermometer showed a minimum temperature of $4^{\circ}9$.

Smithville, 6th: the lowest temperature recorded since the opening of the Signal Service station occurred on the morning of the 6th.

Raleigh: a temperature of 2° was recorded on the 5th, which is the lowest, with one exception, that has occurred during the last five years.

Ohio.—Findlay, Hancock county: the thermometer read

—20° on the morning of the 5th, which is the lowest observed since 1855, when it read —22°.

Norwalk, Huron county: the night of the 24–25th was one of the coldest ever experienced, the temperature falling to —24°.

Wapakoneta, Auglaize county: at sunrise of the 25th the thermometer read —26°, which is the lowest for many years.

Urbana, Champaign county: during the early morning of the 25th the thermometer registered —28°, which is the lowest ever observed.

Dayton, Montgomery county: the weather on the 25th was the coldest ever known; the temperature at 7 a. m. varied, in different localities, from —14° to —28°.

Toledo: the minimum temperature of the 6th, —14°, is the lowest recorded since 1873. Much suffering resulted from the extremely cold weather of the 5th and 6th. Stock froze to death in localities near this city. Reliable reports state that in some parts of the city thermometers read —17°. Very cold weather also prevailed on the 25th, a minimum temperature of —9° occurring on that date.

Columbus: the lowest temperature (—20°) recorded since the opening of this station in 1878, occurred on the morning of the 6th.

Cincinnati: extremely cold weather prevailed on the 5th. The lowest temperature recorded at the signal office, was —9°.7, but thermometers exposed on the surrounding hills indicated a much lower temperature.

The following record furnished by Mr. G. W. Harper, of Mount Auburn, a suburb of Cincinnati, shows the lowest temperatures that have occurred since 1856:

Year.	Month.	Minimum temperature.	Year.	Month.	Minimum temperature.
1856.....	January.....	—14	1875.....	January.....	—10
1857.....	January.....	—13	1876.....	December.....	—10
1864.....	January 1.....	—5	1879.....	January 3.....	—16
1866.....	February.....	—6	1880.....	November 19.....	—12
1870.....	December.....	—8	1884.....	January 5.....	—20

North Lewisburg, Champaign county: the temperature of the 25th, —23°.5, was the lowest experienced for fifty years.

Westerville, Franklin county: on the 25th the temperature fell to —28°, which is the lowest observed for several years.

Fostoria, Seneca county: the night of the 4–5th was the coldest known for many years; on the morning of the 5th the thermometer read —20°.

Bellefontaine, Logan county: at sunrise of the 5th the temperature was —27°, which is the lowest recorded since January 1, 1864, when it was —28°.

Pennsylvania.—Titusville, Crawford county: the weather on the 25th was the coldest known for many years, the thermometer indicating temperatures from —30° to —33°.

South Carolina.—Columbia, Richland county: at 7 a. m. of the 6th the thermometer read 7°; on December 30, 1880, a temperature of 5° occurred.

Seneca, Oconee county: on the morning of the 6th the thermometer read 4°, which is a remarkably low temperature for this latitude.

Charleston: unusually cold weather prevailed on the 6th, the temperature falling to 13°. In only one other instance, since the establishment of the signal office in 1871, has the temperature been as low, viz: 13°, on December 30, 1880.

Tennessee.—Chattanooga: the minimum temperature of the 6th, —1°, is the lowest recorded since the establishment of this station.

Knoxville: a minimum temperature of —16° occurred on the morning of the 6th, which is 2° lower than the lowest temperature previously recorded at the signal office.

Memphis: the minimum temperature of the 6th, —2°, is 4° lower than that for 1875, and is the lowest recorded since the signal office was established in 1871.

Nashville: the minimum temperature, —10°, on the morn-

ing of the 6th is the lowest on the Signal Service records for this place. On January 3d and 9, 1875, minimum temperatures of —8° were recorded.

Texas.—Fort Concho: on the 5th the temperature fell to 4°, which is the lowest recorded during the present season.

Vermont.—Randolph, Orange county, 31st: the month of January has been characterized by unusually cold weather. The mercury froze on three occasions during the month, which is very unusual for this latitude.

Virginia.—Johnsontown, Northampton county: the temperature on the morning of the 7th fell to 4°, which is the lowest that has been observed during the last fifteen years.

Wisconsin.—La Crosse: the mean temperature of the 4th, —22°.7, is the lowest recorded since the establishment of the signal office. The temperature did not rise above —17°; the lowest was —29°. On the 8th a minimum of —23° occurred.

Milwaukee: the mean temperature of the 4th was —20°.7, which is the lowest daily mean recorded since the establishment of the signal office in 1870. On the morning of the 5th the minimum was —24°.3, which is, with the exception of —25° in 1875, the lowest on the signal office records.

Sussex, Waukesha county: the 4th was the coldest day that has occurred during the last twenty years, the daily mean temperature being —24°.5.

Lancaster, Lancaster county: on the morning of the 5th the temperature fell to —34°. The lowest temperature recorded during the last four years is —41°, in 1883.

FROSTS.

Frosts occurred in the various districts on the following dates:

New England.—2d to 31st.

Middle Atlantic states.—1st to 30th.

South Atlantic states.—2d to 14th, 16th to 23d, 25th to 30th.

Florida peninsula.—3d to 23d, 26th.

Eastern Gulf states.—2d to 7th, 9th, 10th, 12th, 13th, 14th, 20th to 26th.

Western Gulf states.—1st to 9th, 11th, 12th, 13th, 20th, 21st, 22d, 24th, 25th, 26th, 28th, 29th.

Tennessee.—1st to 27th, 30th.

Ohio valley.—1st to 27th, 29th, 31st.

Lower lake region.—1st to 31st.

Upper lake region.—1st to 31st.

Extreme northwest.—1st to 31st.

Upper Mississippi valley.—1st to 31st.

Missouri valley.—1st to 31st.

Northern slope.—1st to 31st.

Middle slope.—1st to 31st.

Southern slope.—5th, 7th, 8th, 12th, 20th, 21st, 24th, 25th, 27th.

Southern plateau.—1st to 25th, 27th, 28th, 30th, 31st.

Middle plateau.—1st to 31st.

Northern plateau.—1st, 9th to 24th, 27th to 31st.

North Pacific coast region.—1st, 2d, 9th to 25th, 27th to 31st.

Middle Pacific coast region.—1st, 2d, 9th to 19th, 21st to 24th, 29th, 31st.

South Pacific coast region.—1st, 2d, 7th, 8th, 9th, 12th, 13th, 16th to 19th, 22d, 23d.

Frost was also reported at Brownsville, Texas, on the 3d and 21st.

The following are reports of damage to vegetation in the Southern states by the frosts and cold weather of January:

Limona, Hillsborough county, Florida.—The frost of the 4th damaged pine-apples, oranges, and other vegetation; and the severe weather of the succeeding days killed many tender plants.

Sanford, Orange county, Florida.—Much damage was done to the orange and lemon trees and to vegetables by the cold weather of the 6th.

Mobile, Alabama.—The orange trees and garden vegetables were badly damaged by the cold weather of the 6th. The losses resulting in the surrounding country are estimated at \$500,000.

Jacksonville, Florida, 7th.—Reports from points along the coast, as far south as Manatee, state that the recent cold weather caused serious injury to the orange groves, pine-apples, and garden vegetables.

Dallas, Dallas county, Texas, 11th.—Farmers from the surrounding country report that the oat crop was badly injured by the late cold weather.

Forsyth, Monroe county, Georgia.—The cold weather of the month proved disastrous to vegetation. The oat crop in this state is considered to have been almost totally ruined.

Liberty Hill, Bienville parish, Louisiana, 31st.—The autumn-sown oats were destroyed by the cold weather of January.

Montgomery, Alabama, 31st.—The market gardeners in this vicinity sustained heavy losses by the cold weather of the month.

The following extract is taken from the Montgomery "Advertiser and Mail," of January 30, 1884:

The Commissioner of Agriculture of Georgia has reports from a number of counties in that state, and makes the following estimate of the damage to wheat and oats by the late cold weather: Middle Georgia—damage to wheat, 22.7 per cent.; to oats, 53.75 per cent. Southwest Georgia—damage to wheat, 4.25 per cent.; to oats, 63.75 per cent. North Georgia—damage to wheat, 15.9 per cent.; to oats, 58.45 per cent. East Georgia—damage to wheat, 41 per cent.; to oats, 64.75 per cent. State at large—damage to wheat, 30 per cent.; damage to oats, 60 per cent.

ICE.

Under the heading "ice in rivers and harbors" the subject of ice formation in the northern sections of the country is considered. In the Southern states the following instances of ice formation have been reported:

Alabama.—Auburn, 2d, 3d, 7th, 8th, 9th, 20th, 21st, 26th; Mobile, 2d, 3d, 4th, 6th 9th.

Arizona.—Fort Grant, 1st, 2d, 3d, 11th, 12th, 18th, 19th, 20th, 24th; Wickenburg, 1st to 4th, 12th, 14th, 24th; Yuma, 1st, 2d.

Florida.—Saint Augustine, 3d, 4th, 6th, 9th, 10th, 21st, 22d; Archer, 3d, 4th, 6th, 7th, 9th, 23d; Limona, 4th, 6th, 21st, 22d; Newport, 5th; Jacksonville, 3d, 4th, 6th, 21st, 22d, 23d; Sanford, 6th, 21st, 22d; Cedar Keys, 3d, 22d; Pensacola, 3d, 4th, 6th, 9th, 24th, 25th.

Georgia.—Andersonville, 8th.

Louisiana.—New Orleans, 3d, 5th, 6th, 8th, 21st; Grand Coteau, 9th.

North Carolina.—Brevard: the creeks froze over on the 6th; New River Inlet, 3d, 6th, 7th; Fort Macon, 6th.

Texas.—Galveston, 1st, 2d, 5th, 6th, 24th; Indianola, 1st, 2d, 5th, 6th, 20th, 21st; Brownsville, 3d, 6th.

PRECIPITATION.

[Expressed in inches and hundredths.]

The distribution of rainfall over the United States and Canada for January, 1884, as determined from the reports from more than six hundred stations, is exhibited on chart iv.

Table of rainy and cloudy days, relative humidity, and dew-point for Jan., 1884.

Districts.	† Rainy days.	‡ Cloudy days.	Rel. humidity. °	Dew-point.
			Percentages.	° °
New England.....	From 13 to 17	From 7 to 16	From 73.3 to 80.2	From 11.0 to 24.2
Middle Atlantic states.....	" 12 " 20	" 8 " 15	" 61.2 " 83.0	" 11.9 " 29.8
South Atlantic states.....	" 11 " 20	" 8 " 15	" 66.9 " 80.2	" 29.2 " 44.2
Florida peninsula.....	" 8 " 13	" 5 " 9	" 78.3 " 83.3	" 46.5 " 61.3
East Gulf states.....	" 11 " 18	" 7 " 14	" 70.6 " 73.6	" 31.6 " 37.7
West Gulf states.....	" 9 " 14	" 5 " 10	" 67.3 " 78.4	" 21.0 " 40.3
Rio Grande valley.....	" 3 " 5	" Five	" 61.7 " 73.4	" 37.2 " 43.5
Ohio valley.....	" 12 " 24	" 9 " 17	" 67.2 " 81.2	" 12.2 " 21.0
Tennessee.....	" 16 " 22	" 12 " 18	" 70.3 " 80.3	" 23.6 " 26.4
Lower lake region.....	" 17 " 29	" 14 " 23	" 65.6 " 84.2	" 11.4 " 16.1
Upper lake region.....	" 13 " 27	" 5 " 25	" 63.3 " 79.8	" 0.1 " 15.1
Extreme northwest.....	" 7 " 16	" 3 " 8	" 85.7 " 89.8	" -10.6 " 3.2
Upper Mississippi valley.....	" 10 " 17	" 5 " 12	" 59.1 " 88.6	" 0.9 " 21.2
Missouri valley.....	" 9 " 17	" 3 " 6	" 69.6 " 75.9	" 1.5 " 12.4
Northern slope.....	" 6 " 16	" 2 " 13	" 51.5 " 89.1	" -0.4 " 14.4
Middle slope.....	" 4 " 8	" 1 " 4	" 54.4 " 69.9	" 12.1 " 18.3
Southern slope.....	" 5 " 8	" 2 " 8	" 58.0 " 73.7	" 23.2 " 28.4
Southern plateau.....	" 2 " 11	" 2 " 5	" 52.2 " 65.9	" 22.4 " 27.3
Northern plateau.....	" 7 " 16	" 5 " 8	" 69.9 " 82.7	" 19.3 " 25.0
North Pacific coast.....	" 11 " 16	" 12 " 13	" 77.4 " 81.9	" 31.8 " 37.1
Middle Pacific coast.....	" 9 " 13	" 7 " 14	" 73.3 " 82.3	" 36.5 " 44.5
South Pacific coast.....	" 3 " 8	" 5 " 6	" 40.6 " 62.9	" 27.5 " 40.4
Mt. Washington, N. H.....	Twenty	Five	" 80.9	" 2.2
Pike's Peak, Colo.....	Eight	None	" 77.6	" -3.5
Salt Lake City, Utah.....	Nine	Seven	" 54.6	" 14.7

* Relative humidity corrected for altitude. † Including all days on which rain or snow fell. ‡ Including all cloudy days—with or without snow.

In the first column of the following table is shown the average precipitation for January in each of the various districts for several years, as determined from observations made at the Signal Service stations; in the second column are given the averages for January, 1884, and the third column shows the excess or deficiency of January, 1884, as compared with the average:

Average precipitation for January, 1884.

Districts.	Average for January. Signal-Service observations.		Comparison of Jan., 1884, with the average for several years.
	For several years.	For 1884.	
	Inches.	Inches.	Inches.
New England.....	3.71	5.51	1.80 excess.
Middle Atlantic states.....	3.78	5.83	2.05 excess.
South Atlantic states.....	4.70	5.48	0.78 excess.
Florida peninsula.....	3.34	3.89	0.55 excess.
Eastern Gulf states.....	5.55	5.65	0.10 excess.
Western Gulf states.....	4.00	3.75	0.25 deficiency.
Rio Grande valley.....	1.15	0.78	0.37 deficiency.
Tennessee.....	5.38	6.34	0.96 excess.
Ohio valley.....	3.58	2.98	0.60 deficiency.
Lower lake region.....	2.51	3.39	0.88 excess.
Upper lake region.....	1.79	2.05	0.26 excess.
Extreme northwest.....	0.62	0.37	0.25 deficiency.
Upper Mississippi valley.....	1.86	1.01	0.85 deficiency.
Missouri valley.....	0.74	0.56	0.18 deficiency.
Northern slope.....	0.90	1.24	0.34 excess.
Middle slope.....	0.39	0.30	0.09 deficiency.
Southern slope.....	0.55	0.65	0.10 excess.
Southern plateau.....	0.62	0.42	0.20 deficiency.
Northern plateau.....	3.26	2.64	0.62 deficiency.
North Pacific coast.....	7.13	3.68	3.45 deficiency.
Middle Pacific coast.....	5.22	3.64	1.58 deficiency.
South Pacific coast.....	2.24	1.50	0.74 deficiency.
Mount Washington, N. H.....	4.28	2.45	1.83 deficiency.
Pike's Peak, Colo.....	1.76	0.10	1.66 deficiency.
Salt Lake City, Utah.....	1.36	0.71	0.65 deficiency.

From the above table it will be seen that the precipitation has been excessive in the districts on the Atlantic coast, in the lake region, northern and southern slopes, and in Tennessee. The greatest excess over the average precipitation occurred in New England and the middle Atlantic states, where the departures were 1.80 and 2.05, respectively. In the eastern Gulf states, lake region and northern and southern slopes the departures range from 0.10 to 0.88. In the districts west of the Rocky mountains, extreme northwest, western Gulf states, and Ohio, Missouri, upper Mississippi and Rio Grande valleys, the precipitation for the month has been below the average. The deficiencies in said districts were generally small, except on the Pacific coast where but little over half of the usual amount of rain fell. On the summits of Mount Washington, New Hampshire, and Pike's Peak, Colorado, the deficiencies in the monthly precipitation were 1.83 and 1.66, respectively.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The departures exhibited by the reports from the regular Signal Service stations, are shown in the table of average precipitation for January, 1884. Voluntary observers report the following notes in connection with this subject:

Arkansas.—Lead Hill, Boone county: monthly precipitation, 2.05, is 0.89 below the January average of the two preceding years.

Illinois.—Anna, Union county: monthly precipitation, 2.01, is 1.86 below the January average of the last nine years.

Riley, McHenry county: monthly precipitation, 0.80, is 1.04 below the January average of twenty-three years. In only three years during that period has the January precipitation been less, viz.: in 1865, '66, and '72.

Mattoon, Coles county: monthly precipitation, 0.90, is 1.60 below the January average of the last five years.

Indiana.—Wabash, Wabash county: monthly precipitation, 1.29, is 0.48 below the January average of the last eight years.

Logansport, Cass county: monthly precipitation, 1.80, is 0.27 below the January average of twenty-five years. The monthly snow-fall, 16.22, is 4.67 above the average of the same period.

Kansas.—Independence, Montgomery county: monthly precipitation, 0.68, is 0.87 below the January average of the last twelve years.

Table of excessive, and greatest and least monthly precipitation.

Station.	Specially heavy.			Largest monthly.	Smallest monthly.	
	Date.	Amt.	Duration	Amount.	Station.	Amt.
Alabama.						
Green Springs.....	7	2.40		7.67	Yuma.....	0.05
Do.....	23	2.08			Tucson.....	0.05
Mobile.....	7, 8	2.16		7.40	Phoenix.....	0.16
Do.....	23, 24	2.53			Wickenburg.....	0.19
California.						
Cisco.....				8.40	Benson.....	0.20
Emigrant Gap.....				8.22	Texas Hill.....	0.22
Summit.....				7.60	Prescott.....	0.25
Colfax.....				7.18	Pantano.....	0.31
Newhall.....				6.66	Fort McDowell.....	0.33
Los Angeles.....	27, 28	2.31			Maricopa.....	0.38
San Francisco.....	29, 30	2.19			Fort Thomas.....	0.45
Connecticut.						
New London.....	8, 9	2.32		6.12	Indio.....	0.00
Delaware.						
Saint George's.....				8.45	Needles.....	0.00
District of Columbia.						
Distributing Reservoir.....	9	2.30			Mammoth Tank.....	0.00
Washington City.....	8	2.21			Fenner.....	0.15
Florida.						
Fort Barrancas.....	7	2.09	5 h. 15 m.	7.06	Daggett.....	0.48
Newport.....	24	2.92			Colorado.	
Georgia.						
Quitman.....	24	3.05		6.00	Pike's Peak.....	0.10
Savannah.....	7, 8	2.45			Denver.....	0.22
Forayth.....	18, 19	2.14			West Las Animas.....	0.26
Atlanta.....	18, 19	2.05			Dakota.	
Louisiana.						
Grand Coteau.....	16, 17, 18	4.94		9.88	Huron.....	0.09
Do.....	23	3.19			Fort Buford.....	0.11
Maine.						
Gardiner.....	9	2.69			Fort Hale.....	0.16
Maryland.						
Receiving Reservoir (near Washington).....	9	2.30			Alexandria.....	0.22
Great Falls.....	9	2.04			Fort Yates.....	0.23
Woodstock.....				6.12	Yankton.....	0.25
Massachusetts.						
Charlestown.....				7.74	Fort Totten.....	0.28
Thatcher's Island.....	9	2.10		7.06	Fort Sully.....	0.29
Princeton.....	8	3.17		7.56	Fort Bennett.....	0.31
Provincetown.....	9	2.77		6.58	Fort Sisseton.....	0.35
Boston.....	9	2.14		6.27	Fort Meade.....	0.37
Fall River.....	8, 9	2.25		6.45	Bismarck.....	0.38
Somerset.....				6.00	Florida.	
Mississippi.						
Vicksburg.....	17, 18	2.56		8.20	Limona.....	0.38
Do.....	23	2.32			Larchland.....	0.40
Montana.						
Helena.....	2, 3	2.09			Indian Territory.....	0.46
Nevada.						
Fort McDermitt.....				6.72	Fort Reno.....	0.46
Truckee.....				6.05	Iowa.	
New Hampshire.						
Ashland.....	9	2.52			Humboldt.....	0.20
Wolfborough.....	8, 9	2.02			Cresco.....	0.38
New Jersey.						
Vineland.....	1, 2	2.22		11.56	Indianola.....	0.38
Do.....	24	2.12			Kansas.	
Atlantic City.....				7.17	Salina.....	0.02
Sandy Hook.....				6.73	Dodge City.....	0.08
South Orange.....				6.00	Pretty Prairie.....	0.12
Paterson.....	8, 9	2.47			Allison.....	0.22
Cape May.....	8	2.10			Manhattan.....	0.31
Caldwell.....	8, 9	2.03			Wellington.....	0.46
New York.						
Fort Hamilton.....				7.53	Yates Centre.....	0.48
Oswego.....				6.49	Minnesota.	
New York City.....	8, 9	2.48		6.07	Saint Paul.....	0.48
Mountainville.....	9, 10	3.30			Missouri.	
Fort Columbus.....	8, 9	2.28			Kirksville.....	0.50
North Carolina.						
Hatteras.....	8	2.79		7.64	Fort Assinaboine.....	0.16
Charlotte.....				7.60	Poplar River.....	0.31
New River Inlet.....	7, 8	2.15		6.91	Nebraska.	
Brevard.....	7, 8	2.12		6.72	North Platte.....	0.10
Kitty Hawk.....				6.50	Pawnee City.....	0.11
Fort Macon.....	8	2.51			Fort Niobrara.....	0.28
Lenoir.....	7, 8	2.50			Syracuse.....	0.30
Oregon.						
Astoria.....				6.73	Hastings.....	0.32
Roseburg.....	6, 7	2.08			Dawson.....	0.33
Pennsylvania.						
West Chester.....				7.32	Red Willow.....	0.33
Pittsburg.....	8	2.34			Sargent.....	0.33
Rhode Island.						
Block Island.....				6.43	Fort Robinson.....	0.40
Narragansett Pier.....				6.05	Percu.....	0.40
South Carolina.						
Charleston.....	7, 8	3.98			Table Rock.....	0.40
Tennessee.						
McMinnville.....	31	3.60		13.00	Crete.....	0.41
Ridgely.....				12.84	Stella.....	0.44
Grand View.....	14	3.10		11.36	Nebraska City.....	0.46
Near Smithville.....	23	3.20		10.60	Clear Creek.....	0.50
Flat Creek.....	31	2.47		8.93	Johnson.....	0.50
Careyville.....				8.96	Minden.....	0.50
Manchester.....	31	2.23		8.41	Mission Creek.....	0.50
Greenville.....				8.49	Weeping Water.....	0.50
Beech Grove.....				8.07	Nevada.	
Chuckaluck.....	31	2.70		8.00	Palisade.....	0.37
Savannah.....				7.47	New Mexico.	
Pulaski.....	14	2.25		7.42	Fort Union.....	0.18
Florence Station.....				7.37	Texas.	
Trenton.....				7.30	Fort Stockton.....	0.21

Table of excessive, and greatest and least monthly precipitation.—Continued.

Station.	Specially heavy.			Largest monthly.	Smallest monthly.	
	Date.	Amt.	Duration.	Amount.	Station.	Amt.
<i>Tennessee—Continued.</i>						
Near Alexandria.....				7.30		
Howell.....	31	2.00		7.19		
Franklin.....				7.04		
Grassy Cove.....				6.88		
Ashwood.....	10	2.30		6.80		
Kingston Springs.....				6.72		
Knoxville.....				6.66		
Maryville.....				6.38		
Hurricane Switch.....				6.22		
Rogersville.....				6.20		
Bolivar.....				6.13		
Grief.....				6.09		
Hardison's Mills.....				6.00		
<i>Virginia.</i>						
Lynchburg.....	8	3.92		8.48		
Cape Henry.....				8.43		
Johnsontown.....				6.65		
Accotink.....	8, 9	2.20				
Wellsburg.....	8, 9	2.00				
<i>Washington Territory.</i>						
Neah Bay.....	11	2.80		15.50		
Fort Canby.....	3, 4	2.73		6.45		
New Tecoma.....	3	2.12				
<i>West Virginia.</i>						
Helvetia.....				6.00		

Yates Centre, Woodson county: monthly precipitation, 0.48, is 0.43 below the average of the last four years.

Wellington, Sumner county: monthly precipitation, 0.46, is 0.08 below the January average of the last six years.

Lawrence, Douglas county: monthly precipitation, 1.28, is 0.08 above the January average of the last seventeen years.

Maine.—Gardiner, Kennebec county: monthly precipitation, 5.40, is 2.12 above the January average of the last forty-eight years.

Maryland.—Fallston, Harford county: monthly precipitation, 4.16, is 0.59 above the January average of the last thirteen years. The largest January precipitation of that period, 6.63, occurred in 1882; the smallest, 1.20, occurred in 1872.

Massachusetts.—Worcester, Worcester county: monthly precipitation, 5.04, is 1.30 above the January average of the last forty-five years. The smallest precipitation of that period, 0.98, occurred in 1849; the largest, 8.11, in 1855. The monthly snow-fall, 8, is about one-half of the average amount. The largest January snow-fall of the last forty-five years is 53, for 1882; the smallest is 2, for 1843.

New Hampshire.—Contoocookville, Merrimac county: monthly precipitation, 4.15, is 1.90 above the average of a period of seventeen years. The monthly snow-fall is 17, or about 3 below the average for January.

New Jersey.—South Orange, Essex county: monthly precipitation, 6.00, is 2.14 above the January average of the last fourteen years. The monthly snow-fall, 20, is 5.3 above the January average.

New York.—Palermo, Oswego county: monthly precipitation, 5.05, is 1.95 above the January average for the last thirty-one years, and is the largest January precipitation for that period; the smallest, 1.50, occurred both in 1866 and 1869. The monthly snow-fall, 47.5, is 22 above the average of January for thirty-one years, and is also the largest for that period; the smallest, 2, occurred in 1882.

North Volney, Oswego county: monthly precipitation, 3.70, is 0.53 above the January average of the last twelve years.

Ohio.—Wauseon, Fulton county: monthly precipitation, 1.93, is 0.13 below the January average of the last ten years. The largest January precipitation of that period, 3.50, occurred in 1880; the smallest, 1.29, in 1879.

College Hill, Hamilton county: the snow-fall for January, 1884, is 26, which is, with one exception (26.75, in 1880), the largest monthly snow-fall of which there is a record.

Texas.—New Ulm, Austin county: monthly precipitation, 3.43, is 1.21 below the January average of the last twelve years. The largest January precipitation of that period, 10.56, occurred in 1882; the smallest, 1.13, in 1879.

The general distribution of rainfall for the month of January and the districts of maximum departures from the normal in each year from 1873 to 1883, inclusive, are as follows:

Districts.	Maximum departures.	Year.	Distribution.
		1873...	Deficient on the Pacific coast, in Kentucky, Tennessee, Mississippi, and Alabama; excessive in all other districts, the departures being greatest in Missouri, New Jersey, and Connecticut.
		1874...	Normal in the upper lake region and Minnesota; excessive in the upper Mississippi, lower Missouri, Ohio, and Saint Lawrence valleys, New England, and the middle Atlantic states; deficient in the south Atlantic and Gulf states.
South Atlantic states.....	+ 3.02	1875...	Normal in Minnesota and the middle Atlantic states; excessive in the Saint Lawrence valley, south Atlantic and Gulf states, and on the Pacific coast; deficient in New England, the lake coast; and upper Mississippi, lower Missouri, and Ohio valleys.
Tennessee.....	+ 2.30		
Eastern Gulf states.....	+ 1.75		
Ohio valley.....	+ 1.00		
Missouri valley.....	- 0.67		
Lower lake region.....	- 0.48		
Ohio valley.....	+ 3.15	1876...	Deficient in the districts on the Atlantic coast, in the eastern Gulf states, and Minnesota; excessive in the western Gulf states, lake region, upper Mississippi, Missouri, Ohio, and Saint Lawrence valleys, and on the Pacific coast.
Upper Mississippi valley.....	+ 1.75		
Upper lake region.....	+ 1.05		
South Atlantic states.....	+ 2.15		
Middle Atlantic states.....	- 2.00		
Eastern Gulf states.....	- 1.65		
Middle Atlantic states.....	+ 0.50	1877...	Slightly excessive in the middle Atlantic states and upper Missouri valley; deficient in all other districts.
Upper Missouri valley.....	+ 0.40		
Pacific coast.....	- 1.50		
Western Gulf states.....	- 0.95		
California coast.....	+ 3.76		
New England.....	+ 2.17	1878...	Normal in the eastern Gulf states and at Portland, Oregon; excessive in California, the Saint Lawrence valley, lower lake region, lower Missouri valley, western Gulf states, and in the Atlantic coast districts; deficient in the upper lake region, upper Missouri, upper Mississippi and Ohio valleys, and Tennessee.
South Atlantic states.....	+ 2.13		
Lower lake region.....	+ 1.51		
Tennessee.....	- 1.01		
Upper lake region.....	- 0.99		
Tennessee.....	+ 3.43	1879...	Normal in the middle Atlantic states; excessive in California, Tennessee, Saint Lawrence valley, and western Gulf states; deficient in all other districts.
Western Gulf states.....	+ 0.84		
California coast.....	+ 0.58		
Eastern Gulf states.....	- 2.12		
Portland, Oregon.....	- 1.48		
Ohio valley.....	- 1.33		
Portland, Oregon.....	+ 6.21	1880...	Normal in New England and Florida; deficient in California, Tennessee, the lower lake region, upper Missouri valley, middle and south Atlantic, and Gulf states; excessive in the upper lake region, Minnesota, upper Mississippi, lower Missouri, Ohio, and Saint Lawrence valleys, and at Portland, Oregon.
Ohio valley.....	+ 1.35		
Upper lake region.....	+ 1.06		
Eastern Gulf states.....	- 3.05		
California coast.....	- 2.45		
Middle Atlantic states.....	- 1.24		
Florida peninsula.....	+ 3.80	1881...	Normal in the upper Mississippi valley; deficient in southern California, Tennessee, the lower lake region, and lower Missouri and Ohio valleys; excessive in the north and middle Pacific coast regions, upper Missouri valley, Minnesota, upper lake region, and in the Atlantic and Gulf states.
Eastern Gulf states.....	+ 3.62		
North Pacific coast.....	+ 2.61		
Middle Atlantic states.....	+ 2.18		
South Pacific coast.....	+ 1.20		
Lower lake region.....	- 0.97		
Lower Missouri valley.....	- 0.97		
Tennessee.....	+ 9.92	1882...	Deficient in the Pacific coast regions, middle plateau, northern slope, upper Mississippi and Missouri valleys, south Atlantic states, and Florida; excessive in all other districts.
Western Gulf states.....	+ 4.05		
Middle Atlantic states.....	+ 2.99		
Middle Pacific coast.....	- 4.42		
North Pacific coast.....	- 3.74		
Florida peninsula.....	- 1.27		
Eastern Gulf states.....	+ 5.31	1883...	Normal in the upper lake region, northern slope, Missouri valley, and southern plateau; excessive in the northern plateau, extreme northwest, Tennessee, and Atlantic and Gulf states; deficient on the Pacific coast, in the southern slope, upper Mississippi, Ohio, and Rio Grande valleys, and lower lake region.
South Atlantic states.....	+ 4.00		
Northern plateau.....	+ 1.07		
Middle Pacific coast.....	- 4.14		
South Pacific coast.....	- 1.38		
Rio Grande valley.....	- 1.11		

SNOW.

The dates on which snow fell in the various districts are as follows:

New England.—1st to 4th, 8th to 21st, 24th to 31st.

Middle Atlantic states.—1st to 6th, 8th to 16th, 18th, 19th, 20th, 23d to 30th.

South Atlantic states.—3d, 5th to 9th, 7th, 19th, 20th, 21st, 26th.

Eastern Gulf states.—1st, 5th, 7th, 8th, 23d, 24th.

Western Gulf states.—1st, 6th, 7th, 8th, 15th, 16th, 19th.

Tennessee.—2d to 9th, 11th, 15th, 19th, 20th, 23d, 24th.

Ohio valley.—1st to 20th, 23d to 29th, 31st.

Lower lake region.—1st to 31st.

Upper lake region.—1st to 31st.

Extreme northwest.—2d, 4th, 5th, 7th, 9th to 15th, 17th, 18th, 21st to 26th, 28th to 31st.

Upper Mississippi valley.—1st to 12th, 14th, 15th, 16th, 18th, 19th, 20th, 22d to 25th, 27th to 30th.

Missouri valley.—1st to 11th, 13th, 14th, 15th, 18th, 19th, 20th, 22d to 27th, 29th, 30th, 31st.

Northern slope.—1st to 10th, 13th, 14th, 17th, 18th, 19th, 21st, 22d, 23d, 27th to 31st.

Middle slope.—1st, 3d to 7th, 9th, 10th, 13th to 19th, 23d, 24th, 27th, 28th, 29th.

Southern slope.—10th, 11th, 15th, 16th, 23d.

Southern plateau.—10th, 16th, 17th, 18th, 22d, 26th.

Middle plateau.—2d, 3d, 6th to 10th, 13th, 14th, 24th to 30th.

Northern plateau.—1st to 4th, 6th, 7th, 8th, 22d, 24th to 29th.

Snow also fell at the following stations not included in the districts named above:

Cape Mendocino, California, 28th.

Los Angeles, California, 30th.

Red Bluff, California, 20th, 30th.

Albany, Oregon, 27th.

Portland, Oregon, 25th, 26th, 27th.

Olympia, Washington Territory, 25th.

Snow storms of unusual severity, impeding travel, etc., have been reported as follows:

Oswego, New York.—The snow storm of the 3d interfered with traffic on the railroads. Trains were also delayed on account of snow on the 5th, 9th, and 24th. On the 9th snow was reported to have been from five to ten feet deep in the cuts.

Rochester, New York.—Trains on all railroads running into this city were delayed by snow drifts for several hours on the 3d.

Toledo, Ohio.—Trains on all railroads centering here were delayed by snow drifts on the 2d. Street-railway travel was also interrupted.

Buffalo, New York.—Much inconvenience was experienced on the railroads during the 3d, owing to snow drifts. Railroad traffic was also interrupted on the 8th.

Port Huron, Michigan.—All trains were delayed from twenty to thirty hours by snow on the 3d, and on the Port Huron and Northwestern railroad no trains were run during the 2d and 3d.

Grand Haven, Michigan. The high winds of the 2d caused the snow to drift badly. All incoming trains were delayed from two to five hours.

Decatur, Macon county, Illinois.—Owing to drifting snow no trains ran on the Wabash railroad from December 31st to January 3d.

Mount Pulaski, Logan county, Illinois.—The snow storm of the 1st obstructed the railroads in this part of the state, causing suspension of travel.

Rockford, Winnebago county, Illinois.—Traffic on all railroads was suspended on account of snow blockades on the 3d.

Indianapolis, Indiana.—On the 3d trains were delayed by snow on the Cincinnati, Indianapolis, Saint Louis and Chicago railroad. Much inconvenience and delay occurred on other roads centering here.

Davenport, Iowa.—Trains were delayed, on account of snow, from one to three hours on the 2d. On the 4th trains on all roads were delayed; the freight traffic being entirely suspended.

Scott's Hill, North Carolina.—Heavy snow fell from 2.40 to 4.52 p. m. on the 5th, covering the ground to a depth of two and a half inches. This is the heaviest snow-fall on the records of the signal office.

New River Inlet, North Carolina.—The snow-fall of the 5th was the heaviest that has occurred for many years.

Huron, Dakota.—Trains were delayed by snow drifts on the 5th and 22d.

Humphrey, Cattaraugus county, New York.—During the 8th, 9th, and 10th trains were delayed from ten to twenty-four hours on account of snow drifts.

Lancaster, Grant county, Wisconsin.—Much inconvenience from snow drifts was experienced from the 2d to 7th on all railroads in this part of the state.

Memphis, Tennessee.—Snow fell from 3 a. m. to 4.30 p. m. of the 7th to a depth of more than nine inches, which is the heaviest snow-fall on the signal office records. During the storm of December 28-30, 1876, snow fell to a depth of eight inches.

Leetsdale, Allegheny county, Pennsylvania.—The heavy fall of snow on the 8th and 9th caused entire suspension of all kinds of railroad traffic in this vicinity.

Watertown, Jefferson county, New York.—The snow and sleet storm on the night of the 8-9th delayed trains and caused interruption to telegraphic communication.

Richmond, Madison county, Kentucky.—On the 9th the ground was covered with snow to a depth of fourteen inches, which is the greatest depth ever known in central Kentucky.

Belleville, Province of Ontario.—The snow storm which ended at noon of the 9th was one of the heaviest ever experienced. Traffic on all the railroads, except the Grand Trunk, and business generally were suspended. Reports from various parts of Ontario state that in places the snow fell to a depth of three feet on the level.

Titusville, Crawford county, Pennsylvania.—The snow-fall of the 9th was the heaviest ever known to have fallen in one day. The country roads were blockaded in all directions, and trains on the railroads were abandoned. The roofs of many buildings were crushed beneath the weight of snow.

Pittsburg, Pennsylvania.—The snow storm of the 8th in western Pennsylvania was one of the heaviest that has occurred for many years. Trains on all railroads were delayed from one to eight hours, and much difficulty was experienced on the street railways.

Demster, Oswego county, New York.—The total depth of snow-fall from the 1st to 9th of January measured thirty-three inches. All railroad communication was interrupted by the heavy snow-fall of the 8th.

Wheeling, West Virginia.—A heavy snow storm prevailed on the 8th. The ground was covered to an average depth of twenty inches. Serious delay of trains occurred on the railroads. Street-car traffic was entirely suspended during the morning.

Harrisonburg, West Virginia.—One of the severest snow storms that has occurred for several years prevailed throughout the valley of Virginia on the 8th. Travel of all kinds was impeded.

Fort Totten, Dakota.—The railroad between Creel City and Grand Forks was blockaded from the 22d to 27th.

LARGEST MONTHLY SNOW-FALLS.

[Expressed in inches and tenths.]

The following are the largest monthly snow-falls reported from the various states and territories during the month:—

Arizona.—Fort Apache, 6.8.

Arkansas.—Lead Hill, about 10.2.

California.—Cisco, 84; Emigrant Gap, 82.25; Summit, 76; Alta, 18.

Colorado.—Pueblo, 5.7.

Connecticut.—Bethel, 10.8; New Haven, about 8; Southington, 8.

Dakota.—Fort Lincoln, 10; Deadwood, 8.5; Rapid City, 7.2; Fort Totten, 6.8; Fort Randall, 5.8; Webster, 5.

Delaware.—Saint George's, 14; Delaware Breakwater, about 11.

District of Columbia.—West Washington, 5.8.

Idaho.—Fort Lapwai, 6; Lewiston, 6.

Illinois.—Anna, 16.3; Polo, 14.5; Rockford, 14; Chicago, 12.6; Springfield, about 12; Swanwick, 10.2; Bunker Hill, 9.6; Riley, 7.8; Mattoon, 7.7; Cairo, 7.3; Larchland, 6.2; Sycamore, 6.1; Edgington, 6; Peoria, 6.

Indiana.—Blue Lick, 22.1; Degonia, 18.5; Hanover, 17.5; Laconia, 17.5; Vevay, 17.5; Logansport, 16.3; Wabash, 15; Fort Wayne, 14.5; Sunman, 14.5; Corydon, 14.4; Griffin Station, 14.2; Glenwood, 13.5; Marengo, 12.6; Salem, 12.3; Evansville, 12; Worthington, 11.8; Richmond, 11; Lafayette, 10.2; Columbus, 10; Indianapolis, about 9.5; Huntingburg, 9.4; Franklin, 8; Noblesville, 7.5; Terre Haute, 7.

Iowa.—Independence, 13.5; Logan, 13; Dubuque, 9.7; Muscatine, 9; Cedar Rapids, 8.5; Oskaloosa, 7.2; Keokuk, 6.9; Davenport, 6.7; Monticello, 6.1; Des Moines, about 6; Fort Madison, 6.

Kansas.—Lawrence, 12; Leavenworth, 9.5; Clay Centre, 6.6.

Kentucky.—Frankfort, 17.8; Bowling Green, 16.

Maine.—Portland, about 32; Orono, 17.5; Eastport, about 16; Gardiner, 14.5; Cornish, 13; Fort Preble, 12.

Maryland.—Cumberland, 16; Fallston, 14; Sandy Springs, 11.7.

Massachusetts.—Rowe, 20; Boston, about 14; Thatcher's Island, 10.7; Charlestown, 9.5; Princeton, 9; Westborough, 8; Worcester, 8; Taunton, 6.5; Fall River, 5.

Michigan.—Traverse City, 29.5; Alpena, 26.8; Grand Haven, 26.7; Ionia, 26; Northport, 24.2; Lansing, 21.4; Hudson, 20.4; Thornville, 19; Detroit, 18; Marshall, 17.9; Port Huron, 16; Coldwater, about 13; Swartz Creek, 12.2; Ann Arbor, about 11; Hillsdale, 9.3; Marquette, 9.1; Fort Brady, 7.3.

Minnesota.—Chester, 6 to 8; Minneapolis, 7.3; Duluth, 6.6; Moorhead, 5.5; Northfield, 5.5.

Missouri.—Pierce City, 9.5; Lebanon, 9.4.

Montana.—Helena, 35.4; Fort Custer, 28.5; Fort Maginnis, 14.7; Fort Ellis, 12.5; Fort Shaw, 8.2; Fort Benton, 5.6.

Nebraska.—Fremont, 10.2; Genoa, 7; Omaha, about 7; Johnson, 6; Red Willow, 5.5; Crete, 5.4; De Soto, 5.4.

Nevada.—Fort McDermitt, 67.2; Truckee, 66.5; Boca, 46; Carson City, 24.5; Reno, 16.5; Elko, 12; Humboldt, 12; Otego, 10.5; Winnemucca, 10.5; Beowawe, 7.5; Battle Mountain, 7; Hot Springs, 7; Carlin, 6; Halleck, 6; Browns, 5.5; Golconda, 5.1.

New Hampshire.—Ashland, about 40; Wolfborough, about 30; Bristol, 28; Lake Village, about 28; Woodstock, 25.1; Mount Washington, about 24; Belmont, 23.1; Contoocookville, 17.

New Jersey.—Little Egg Harbor, 26.2; Somerville, 22; South Orange, 20; Caldwell, 14.1; Newark, 13.2; Paterson, 12.5; Phillipsburg, 12.2; Vineland, 12; Moorestown, 10; Barnegat City, about 8.5.

New Mexico.—Deming, 5; Lordsburg, 3.

New York.—Oswego, about 60; Rochester, 50.5; Palermo, 47.5; Auburn, 37; Penn Yan, 31.1; Humphrey, 30; Ithaca, 29.3; Buffalo, 28.5; Madison Barracks, 28; Cooperstown, 23; Factoryville, 22.7; Fort Niagara, 22.3; Menand Station (near Albany), 20.9; Hector, 20; Albany, about 20; Mountainville, 13.8; Friendship, 12; New York City, about 12; White Plains, 11; David's Island, 9.5.

North Carolina.—Ogreeta, about 10; Kitty Hawk, 6.1; Highlands, 6.

Ohio.—Jacksonburg, 29; College Hill, 26; Portsmouth, 26; Canal Dover, 25; Cleveland, 24.9; North Lewisburg, 23; Columbus, 21; Toledo, 19.2; Ruggles, 18; Wauseon, 18; Westerville, 17.9; Cincinnati, 13.6; Sandusky, 8.5.

Oregon.—Fort Klamath, 26.8.

Pennsylvania.—Erie, 41; Leetsdale, 35.1; Pittsburg, about 35; Wellsborough, 29.8; Troy, 28; Grampian Hills, 27; Easton, 15.5; Tamagua, about 15; West Chester, 14.8; Catawissa, 13.3; Wilkesbarre, 12; Fallsington, 11.6; Millville Depot, 11.3; Germantown, 11; Chambersburg, 9.2; Blooming Grove, 8.6; Hulmeville, 7.

Rhode Island.—Narragansett Pier, 7.5; Block Island, 7.4.

Tennessee.—Smithville, near, 22.5; Austin, 22.4; Nashville, 22; Knoxville, about 20; Riddleton, 19; Kingston Springs, 18; Rogersville, 18; Ashwood, 17.9; Franklin, 17.5; Waverly, 17.5; Flat Creek, 16; Manchester, 15.5; Beech Grove, 15;

Maryville, 15; Bolivar, 14.5; McKenzie, 14; Savannah, 14; Jonesborough, 13; McMinnville, 13; Huntingdon, 12.5; Trenton, 12.4; Hardison's Mills, 12; Milan, 11.4; Grassy Cove, 11; Sailor's Rest, 11; Howell, 10; Chattanooga, about 10; Hurricane Switch, 10; Gadsden, 8.8; Careyville, 8; Pulaski, 8; Dyersburg, 6.1; Chuckaluck, 5.8; Grief, 5.5.

Texas.—Clarksville, 3.4; El Paso, 2.5.

Utah.—Logan, 10; Blue Creek, 9.9; Nephi, 8; Promontory, 7; Corinne, 5.5; Ogden, 5.5; Terrace, 5.

Vermont.—Charlotte, about 36; Strafford, 36; Newport, 34.5; Woodstock, 31.5; Lunenburg, 30; Burlington, 24; Dorset, 23.

Virginia.—Lynchburg, about 35; Marion, 10; Wytheville, about 10; Cape Henry, 9.6; Accotink, 8.2; Variety Mills, 6; Johnstown, 5.8.

West Virginia.—Wellsburg, 27; Helvetia, 26.2.

Washington Territory.—Fort Spokane, 9.

Wisconsin.—Madison, 16.6; Milwaukee, 16.4; Neillsville, 15.3; Lancaster, 14.8; Embarrass, 13.5; Sussex, 11.8; Manitowoc, about 8.5; Evansville, 8.1; Franklin, 8; Wausau, 7.3; Beloit, 7; Ripon, 5.5; La Crosse, 5.2.

Wyoming.—Cheyenne, 7.6.

DEPTH OF UNMELTED SNOW ON GROUND AT END OF MONTH.

[Expressed in inches and tenths.]

Alabama.—Auburn, 1.

Colorado.—Pike's Peak, 8; Fort Collins, 2.

Connecticut.—Southington, 4; Bethel, 3; New Haven, 2; New London, 1.2.

Dakota.—Webster, about 12; Fort Buford, about 8; Deadwood, 5.5; Bismarek, 4; Rapid City, 1; Alexandria, 0.5; Fort Bennett, trace; Huron, trace.

Delaware.—Saint George's, 1.

Illinois.—Riley, 0 to 12; Sycamore, 6; Edgington, about 6; Chicago, 2.5.

Indiana.—Logansport, 2.5; Wabash, 2.5; Fort Wayne, 1; Lafayette, in drifts; Griffin Station, trace; Indianapolis, trace.

Iowa.—Monticello, 9; Independence, 3 to 6; Guttenburg, 6; Cedar Rapids, about 5; Cresco, 4; Muscatine, 4; Dubuque, 3; Humboldt, in drifts; Davenport, trace; Indianola, trace.

Maine.—Gardiner, 13; Orono, 8; Eastport, 3.5; Portland, 3.

Maryland.—Cumberland, 3; Baltimore, trace; Fallston, trace; Sandy Springs, trace.

Massachusetts.—Rowe, 23; Westborough, 5; Boston, 2; Milton, 2; Charleston, 0.8; Amherst, trace; Worcester, trace.

Michigan.—Traverse City, 16; Grand Haven, 15; Northport, 14; Thornville, 10; Marquette, 7; Alpena, 6; Hudson, 5; Mackinaw City, 5; Swartz Creek, 5; Hillsdale, 3; Escanaba, 2.5; Detroit, 0.5; Port Huron, 0.5.

Minnesota.—Chester, 15; Moorhead, 12; Curryville, about 6.5; Northfield, 6; Saint Paul, 4.8; Duluth, 3.5; Saint Vincent, 3.

Montana.—Poplar River, 8; Fort Custer, 6; Fort Maginnis, 3; Helena, 3; Fort Assinaboine, 1; Fort Shaw, 1; Fort Benton, 0.5.

Nebraska.—Fremont, trace; North Platte, trace; Omaha, trace.

Nevada.—Carson City, 10.

New Hampshire.—Mount Washington, 20.

New Jersey.—South Orange, 4; Newark, 3; Paterson, 3; Somerville, 3; Sandy Hook, trace; Vineland, trace.

New York.—North Volney, 26 in the woods; Auburn, 21; Factoryville, 20; Palermo, 20; Cooperstown, 18; Humphrey, 18; Rochester, 17; Hector, 16; Oswego, 16; Ithaca, 12; Menand Station (near Albany), 7; Albany, 6; Mountainville, about 6; White Plains, 4; Buffalo, 2; Friendship, 2.

Ohio.—Cleveland, 3; Sandusky, 2; North Lewisburg, 1; Toledo, 1; Westerville, 1; Ruggles, trace; Wauseon, trace.

Pennsylvania.—Wellsborough, 24.3; Grampian Hills, 18; Tamaqua, about 15; Millville Depot, 14; Troy, 12; Catawissa, 7.5; Chambersburg, 4; Wilkesbarre, 4; Haverford College, 3; Leetsdale, 3; Pittsburg, 3; Hulmesville, 2; Erie, trace; Fallsington, trace.

Utah.—Logan, 3; Nephi, 1.

Vermont.—Strafford, 24; Charlotte, about 24; Woodstock, 16; Dorset, 14; Burlington, 3.

Virginia.—Wytheville, trace.

Washington Territory.—Spokane Falls, 6.

West Virginia.—Wellsburg, 2.

Wisconsin.—Neillsville, 20; Embarrass, 14; Lancaster, 9.5; Ripon, 9; Franklin, 8; Beloit, 6.5; Evansville, 6; Sussex, 6; La Crosse, 4; Milwaukee, 2.5; Manitowoc, 1.

Wyoming.—Cheyenne, 2.

SNOW FROM A CLOUDLESS SKY.

Huron, Dakota.—Snow fell from a cloudless sky several times during the morning of the 7th.

Indianapolis, Indiana.—During the forenoon of the 8th light snow fell when no clouds were visible except, occasionally; a few cirro-cumulus were observed in the upper atmosphere. A dense haze prevailed at the time.

Cincinnati, Ohio.—Snow fell from a cloudless sky from 11 to 11.15 p. m. of the 19th.

Eastport, Maine.—Light snow fell from 12.40 to 5.10 a. m. of the 21st, when no clouds were visible.

SLEET.

Alabama.—Auburn, 7th, 8th, 24th; Green Springs, 5th, 7th, 10th; Montgomery, 7th.

Arkansas.—Fort Smith, 27th.

Connecticut.—New Haven, 1st, 8th, 10th.

Dakota.—Fort Totten, 12th.

District of Columbia.—Washington City, 8th, 20th, 28th.

Florida.—Pensacola, 24th.

Georgia.—Atlanta, 4th, 5th, 7th, 8th; Augusta, 7th, 8th.

Illinois.—Springfield, 27th.

Indiana.—Sunman, 1st.

Iowa.—Davenport, 18th; Independence, 27th; Keokuk, 27th.

Kansas.—Clay Centre, 27th; Fort Scott, 27th; Independence, 26th.

Louisiana.—Shreveport, 7th; New Orleans, 24th.

Maine.—Bangor, 2d; Eastport, 2d, 24th; Portland, 25th.

Maryland.—Baltimore, 8th, 15th.

Massachusetts.—Boston, 1st, 2d; Rowe, 30th.

Minnesota.—Northfield, 29th.

Mississippi.—Vicksburg, 7th.

Montana.—Fort Benton, 8th.

Nebraska.—Omaha, 18th.

New Hampshire.—Mount Washington, 24th, 25th.

New York.—Fort Columbus, 10th, 11th; Mountainville, 8th, 28th.

North Carolina.—Charlotte, 7th, 8th; Weldon, 8th, 28th.

Ohio.—Cleveland, 10th; Toledo, 10th.

Pennsylvania.—Chambersburg, 8th, 24th; Erie, 29th, 31st; Leetsdale, 10th.

Rhode Island.—Narragansett Pier, 1st.

South Carolina.—Aiken, 7th; Charleston, 7th; Stateburg, 7th, 17th.

Tennessee.—Chattanooga, 23d, 24th; Memphis, 11th; Milan, 18th; Nashville, 11th, 23d.

Texas.—Fort Concho, 15th, 16th; Fort Davis, 16th, 17th; Fort Elliott, 17th; Fort Stockton, 16th, 17th; Indianola, 1st; Rio Grande City, 18th.

Virginia.—Lynchburg and Variety Mills, 8th, 28th.

Washington Territory.—Dayton, 2d, 3d, 5th; Fort Spokane, 5th.

HAIL.

At San Francisco, California, a shower of hail, lasting two minutes, began at 4.50 p. m. of the 27th.

Hail is also reported to have occurred at the following stations:

Gardiner, Maine, 1st, 2d.

Andersonville, Georgia, 2d.

Weldon, North Carolina, 8th.

Factoryville, New York, 8th, 9th.

Newark, New Jersey, 10th.

Somerville, New Jersey, 10th.
 Frankfort, Kentucky, 14th.
 Bristol, New Hampshire, 24th.
 Yates Centre, Kansas, 27th.
 Blooming Grove, Pennsylvania, 30th.
 Embarrass, Wisconsin, 30th.
 Highlands, North Carolina, 31st.
 Milan, Tennessee, 31st.

WINDS.

The most frequent directions of the wind during January, 1884, at the Signal Service stations are shown on chart iii. by arrows flying with the wind. In the lake region and New England they were from south to west; on the Atlantic coast south of Massachusetts they were variable, between north and south through west; on the immediate Gulf coast they were northerly; in the Ohio valley, from south to west; in Tennessee and the northern parts of Georgia and Alabama, from west to northwest; in the extreme northwest, upper Mississippi and Missouri valleys, and over the eastern slope of the Rocky mountains they were variable, between north and south through west; on the Pacific coast they were generally from northeast to southeast.

TOTAL MOVEMENTS OF THE AIR.

[In miles.]

In the following table are given the stations reporting the largest and smallest total movements of the air in each of the various districts:

Districts.	Stations reporting largest.	Miles.	Stations reporting smallest.	Miles.
New England.....	Block Island, R. I.....	14,115	New Haven, Conn.....	6,309
Middle Atlantic states.....	Sandy Hook, N. J.....	15,215	Lynchburg, Va.....	2,763
South Atlantic states.....	Fort Macon, N. C.....	12,271	Augusta, Ga.....	2,893
Florida peninsula.....	Key West.....	9,343	Sanford.....	5,972
Eastern Gulf states.....	New Orleans, La.....	6,817	Montgomery, Ala.....	3,891
Western Gulf states.....	Indianola, Tex.....	11,715	Little Rock, Ark.....	4,035
Ohio valley.....	Louisville, Ky.....	6,971	Cincinnati, Ohio.....	4,542
Tennessee.....	Nashville.....	5,320	Knoxville.....	4,989
Lower lake region.....	Buffalo, N. Y.....	12,224	Toledo, Ohio.....	6,232
Upper lake region.....	Milwaukee, Wis.....	10,685	Duluth, Minn.....	5,342
Extreme northwest.....	Moorhead, Minn.....	7,413	Bismarck, Dak.....	5,441
Upper Mississippi valley.....	Saint Louis, Mo.....	10,686	Saint Paul, Minn.....	4,253
Missouri valley.....	Huron, Dak.....	7,379	Fort Bennett, Dak.....	4,526
Northern slope.....	Cheyenne, Wyo.....	10,751	Helena, Mont.....	2,850
Middle slope.....	Fort Elliott, Tex.....	9,713	West Las Animas, Colo.....	5,650
Southern slope.....	Fort Concho, Tex.....	7,180	Fort Davis, Tex.....	4,468
Southern plateau.....	Fort Grant, Ariz.....	5,395	El Paso, Tex.....	2,823
Northern plateau.....	Dayton, Wash. T.....	3,001	Lewiston, Idaho.....	826
North Pacific coast region.....	Fort Canby, Wash. T.....	11,562	Roseburg, Oreg.....	2,017
Middle Pacific coast region.....	Cape Mendocino, Cal.....	12,477	Sacramento, Cal.....	4,979
South Pacific coast region.....	Los Angeles, Cal.....	5,166	San Diego, Cal.....	4,343

Record incomplete; about 35 miles lost during gale of the 3d. † Record for twenty-three days only.

HIGH WINDS.

On the summit of Mount Washington velocities of fifty miles or more per hour occurred on the following dates: 2d to 18th, 21st to 24th, 26th, 27th, 30th, 31st. The highest velocities recorded were: 90, nw., 3d; 108, nw., 4th; 104, nw., 5th; 80, nw., 6th; 112, se., 9th; 130, nw., 10th (maximum for the month); 84, nw., 21st; 88, nw., 22d; 80, nw., 27th; 116, sw., 30th; 88, w. and nw., 31st.

On the summit of Pike's Peak, velocities of fifty miles or more per hour occurred on the following dates: 1st to 6th, 8th, 9th, 19th, 22d, 26th to 29th, 31st. The highest velocities recorded were: 72, nw., 5th; 72, sw., 29th; 76, w., 31st (maximum for the month).

At Cape Mendocino, California, the highest velocities were: 64, se., 2d; 52, se., 3d; 100, se., 4th and 5th; 68, se., 6th; 100, se., 26th.

Other stations reporting wind-velocities of fifty miles or more per hour are as follows:

Fort Canby, Washington Territory, 52, se., 4th; 72, se., 5th; 64, s., 6th.

Barnegat City, New Jersey, 68, e., 9th.

Fort Macon, North Carolina, 68, se., 8th; 56, sw., 9th.

Kitty Hawk, North Carolina, 60, ne., 5th; 64, ne., 8th.

Buffalo, New York, 51, w., 2d; 59, w., 3d.

Sandy Hook, New Jersey, 56, w., 2d; 50, e., 8th and 9th; 52, w., 10th.

Cape May, New Jersey, 56, nw., 2d; 50, e., 8th; 52, w., 9th.

Portland, Maine, 56, se., 9th.

Indianola, Texas, 54, n., 1st.

Provincetown, Massachusetts, 53, se., 9th.

Delaware Breakwater, Delaware, 52, w., 13th.

Fort Maginnis, Montana, 52, sw., 11th.

Cape Henry, Virginia, 50, se., 8th.

LOCAL STORMS.

Buffalo, New York.—A severe gale prevailed on the 3d, during which the wind reached a maximum velocity of 59 miles from the west at 2.10 p. m. At 6.40 p. m. the anemometer cups were blown away. This storm occurred after the passage of low areas numbers i. and ii.

Cape Mendocino, California.—A violent storm occurred on the 4th. For fifteen minutes the wind blew at the rate of 100 miles per hour, and at times it reached a velocity of 120 miles for shorter intervals. The anemometer cups were blown away at 8.05 p. m. The fence around the station was also blown away, and the wood stored in the yard was scattered over the reservation. The storm continued during the 5th; at 10.15 a. m. the arms of the anemometer were broken off by the violence of the wind. This storm, occurring in connection with low area iv., is considered to have been one of the severest ever experienced there. On the 26th the wind suddenly veered to southeast during the early morning and increased in force until noon, when a wind-velocity of 100 miles was recorded; a few minutes later the anemometer was again blown away. The maximum hourly velocity of the wind is estimated at 125 miles. The storm continued without abatement until 3.30 p. m., when the wind moderated to about 50 miles per hour. No serious damage resulted from the storm, other than the cutting off of telegraphic communication. It occurred during the existence of low area xvi.

Narragansett Pier, Rhode Island.—During a brisk westerly gale on the 4th (succeeding low area ii.) the schooner "Adriane" was driven ashore on Block Island.

San Francisco, California.—A maximum wind-velocity of 28 miles se., occurred on the 5th. At Point Lobos the wind attained a velocity of 68, se., at 12.15 p. m., when the anemometer cups were blown away. The water in San Francisco bay was very rough, causing some of the vessels to drag anchor. Considerable damage was done at Oakland by the high wind. This storm occurred during the passage of low area number iv.

Galveston, Texas.—During a "norther" on the 7th (low area iv.) the bark "Norma" went ashore a few miles west of this city, and the steamer "Aransas" was driven by a high wind into the bend of the channel, where she was grounded.

Mobile, Alabama.—Reports from Fort Morgan, Alabama, state that between 5.30 and 6.30 p. m. of the 5th, the northerly wind attained a velocity of 49 miles per hour, causing the ship "Halliope" to drag anchor, and resulting in other damage to shipping interests.

Barnegat City, New Jersey.—A very severe storm prevailed during the early morning of the 9th, (low area iv.) the wind reaching a velocity of 68 miles per hour, and for five minutes a velocity of 84 miles was recorded. The barkentine "Elmina" was driven ashore north of Beach Haven on the 8th; she began going to pieces at 10 p. m., and by 3 a. m. of the 9th she was a total wreck. All on board were lost; the number of persons is supposed to have been about ten.

Point Judith, Rhode Island.—The storm of the 9th (low area iv.) was very severe during the early morning; the highest velocity of the wind, 65 miles, occurred at 3 a. m.

Provincetown, Massachusetts.—A severe gale occurred on the 9th (low area iv.), the wind reaching a velocity of 53 miles se. Some slight damage was sustained by vessels in the harbor.

Thatcher's Island, Massachusetts.—A violent southeasterly gale occurred on the 9th (low area iv.). It reached its height

at 4.55 p. m., when a maximum velocity of 50 miles per hour was recorded. No damage resulted from the storm in this vicinity.

Portland, Maine.—A violent gale occurred on the 9th (low area iv.). A wind-velocity of 56 miles se. was recorded at 8.30 a. m., and for five minutes the wind blew at the rate of 60 miles per hour. The schooner "Etna" was foundered off Portland Head Light, and three fishing schooners were driven ashore on Cape Elizabeth.

Eastport, Maine.—A gale occurred on the 9th lasting from 9.25 a. m. until 4.15 p. m. (low area iv.), during which a maximum wind-velocity of forty-six miles se. occurred.

Troy, New York.—A violent storm swept over Rensselaer county between 1 and 4 a. m. of the 9th (low area iv.) Its track was about four miles in width. In the town of Poestenkill every house was damaged; chimneys were blown down and barns moved from their foundations.

SAND STORMS.

Arizona.—Maricopa, 10th, 11th; San Carlos and Willcox, 11th; Fort McDowell, 20th; Yuma, 23d.

NAVIGATION.

STAGE OF WATER IN RIVERS.

The highest stage in the Ohio river was noted at Cincinnati, Ohio, and Louisville, Kentucky, on the 1st, and at Pittsburg, Pennsylvania, on the 2d.

The Missouri river continued frozen at Leavenworth, Kansas, and at all points northward, throughout the month.

The Mississippi remained frozen during the month at Keokuk, Iowa, and points above.

The Arkansas river was frozen at Fort Smith, Arkansas, on the 7th, 8th, 9th, and 12th; and at Little Rock, Arkansas, from the 7th to 13th.

In the following table are shown the danger-points at the various river stations; the highest and lowest stages for January, 1884, with the dates of occurrence; and the monthly ranges:

Heights of rivers above low-water mark, January, 1884.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River:</i>	<i>Fl. In.</i>		<i>Fl. In.</i>		<i>Fl. In.</i>	<i>Fl. In.</i>
Shreveport, Louisiana.....	29 9	1	13 5	31	10 2	3 3
<i>Arkansas:</i>						
Little Rock, Arkansas.....	33 0	1	5 10	29, 30	3 10	2 0
Fort Smith, Arkansas.....		6	— 1 7½	26	— 3 6½	1 11
<i>Missouri:</i>						
Yankton, Dakota.....	30 0					
Omaha, Nebraska.....	16 0					
Leavenworth, Kansas.....	21 0					
<i>Mississippi:</i>						
Saint Paul, Minnesota.....	14 6					
La Crosse, Wisconsin.....	18 0					
Dubuque, Iowa.....	21 10					
Davenport, Iowa.....	15 0					
Keokuk, Iowa.....	14 6					
Saint Louis, Missouri.....	30 0	18	12 4	4	3 4	9 0
Cairo, Illinois.....	40 0	3	35 3	16	23 2	12 1
Memphis, Tennessee.....	34 0	5	26 9	18	17 7	9 2
Vicksburg, Mississippi.....	41 0	11, 12	36 2	1	23 11	12 3
New Orleans, Louisiana.....	— 2 6	20	— 3 9	1	— 10 6	6 9
<i>Ohio:</i>						
Pittsburg, Pennsylvania.....	20 0	2	17 2	24, 26, 28	3 2	14 0
<i>Cincinnati, Ohio:</i>						
Cincinnati, Ohio.....	50 0	1	38 11	13	15 5	23 6
<i>Louisville, Kentucky:</i>						
Louisville, Kentucky.....	24 0	1	19 10	13	7 0	12 10
<i>Cumberland:</i>						
Nashville, Tennessee.....	42 0	17	31 11	10	9 4	22 7
<i>Tennessee:</i>						
Chattanooga, Tennessee.....	33 0	21	14 10	10	3 5	11 5
Knoxville, Tennessee.....		20	6 4	8	1 7	4 9
<i>Monongahela:</i>						
Pittsburg, Pennsylvania.....	39 0	2	17 2	24, 25, 28	3 2	14 0
<i>Savannah:</i>						
Augusta, Georgia.....		20	22 8	10	5 0	17 8
<i>Willamette:</i>						
Portland, Oregon.....		10	8 10	24	0 8	8 2
<i>Red Bluff, California:</i>						
Red Bluff, California.....		6	6 0	3, 4, 5	0 10	5 2
<i>Sacramento, California:</i>						
Sacramento, California.....		31	13 6	5, 23, 24	7 10	5 8
<i>Mobile:</i>						
Mobile, Alabama.....		18	15 8	25	12 0	3 8
<i>Colorado:</i>						
Yuma, Arizona.....		2, 3	16 8	17, 18	14 4	2 4

* Below high-water mark of 1874 and 1883. † Frozen throughout the month. ‡ Frozen part of month; see text. § below bench-mark.

ICE IN RIVERS AND HARBORS.

Saint Croix river.—Calais, Maine: the river closed to navigation during the night of the 15–16th.

Narragansett bay.—Narragansett Pier, Rhode Island: large fields of ice passed out of the bay on the 20th. At 4 a. m. an ice-field, fully three miles in length, passed this station; ice continued to pass until the afternoon of the 21st.

Block Island, Rhode Island: the harbor froze on the 6th.

Broad lake.—Burlington, Vermont: the lake froze over on the 9th, which is the earliest closing of the last ten years.

Lake Champlain.—Charlotte, Vermont: the lake began to freeze on the 8th; on the 10th, it was firmly frozen.

New Haven harbor.—New Haven, Connecticut: the harbor froze on the 6th, but the ice was broken up by the storm of the 9th; some of the vessels sustained damage in consequence.

Housatonic river.—Bethel, Fairfield county, Connecticut: the ice broke up in the river on the morning of the 9th.

New York harbor.—New York City: the flood-tide on the morning of the 13th brought up from the harbor an immense floe of ice which blockaded East river from shore to shore. At 6.30 a. m. the end of pier 27 was carried away and a two-masted schooner and a lighter on the north side of the pier were sunk. The damage to the pier is estimated at \$3,000. Navigation was interrupted for several hours during the morning. On the 22d navigation was interrupted by ice-fields in the upper harbor. All sailing vessels passing through the narrows on that date were compelled to employ tugs.

David's Island: persons crossed on the ice to the mainland on the 27th.

Barneget bay.—Barneget City, New Jersey: the bay closed by ice on the 7th, cutting off communication with the mainland. It remained frozen until broken up by the storm of the 9th. It froze over again on the evening of the 20th.

Little Egg harbor.—Little Egg harbor, New Jersey: large quantities of ice in the harbor on the 9th.

Hudson river.—New York City: considerable floating ice on the 12th.

Delaware river.—Philadelphia, Pennsylvania: from Trenton, New Jersey, to Port Richmond, the ice was sufficiently strong to permit the crossing of teams on the 8th. The river below Philadelphia was frozen nearly across for the first time in several years.

Delaware bay.—Delaware Breakwater, Delaware: the harbor was filled with ice on the 7th.

Chincoteague bay.—Chincoteague, Virginia: the bay froze over on the 6th, but the ice broke up on the afternoon of the 8th. Ice formed rapidly on the bay on the 21st.

Chesapeake bay.—Baltimore, Maryland: brisk southeast to northeast winds on the 8th drove large quantities of ice from the bay into the river and harbor, causing much inconvenience to vessels. Large quantities of ice were driven into the track of vessels on the west shore. The large amount of ice in the bay on the 9th rendered navigation very difficult. Many oyster boats were ice-bound and much suffering was experienced by their crews.

Severn river.—Annapolis, Maryland: the northeast wind on the night of the 8–9th cleared Annapolis harbor of ice and opened navigation.

Patapsco river.—Baltimore, Maryland: ice formed rapidly in the harbor on the 6th, and on the 7th it varied from two to three inches in thickness. Large quantities of ice were driven into the harbor and river by the strong easterly winds on the 28th, rendering navigation difficult.

Potomac river.—Washington City, District of Columbia: river frozen over on the 1st; ice strong enough for skating from about the 7th to 27th; the ice was softened considerably by the increasing temperature on the 30th. The ferry steamer "City of Alexandria" made her way through the ice to Alexandria, Virginia, on this date. On the 31st the channel was clear as far as Georgetown, District of Columbia; above this point the ice remained unbroken on the 31st.

Choptank river.—Oxford, Maryland: a breaking of the ice

occurred during the night of the 8-9th. No serious damage resulted, although a number of vessels were carried several miles from harbor by the ice.

Susquehanna river.—Port Deposit, Maryland: on the 9th the ice in the river was seven inches thick. At the close of the month the ice in the Susquehanna was sixteen inches thick at Wilkesbarre and Catawissa, Pennsylvania.

Oswego river.—Oswego, New York: the river was clear of ice from the upper bridge to the harbor on the 18th; the harbor froze over on the 25th.

Detroit river.—Detroit, Michigan: the river was frozen from shore to shore, on the 1st; nearly all the ice went out of the river on the 30th; on the 31st the river was full of floating ice.

Monongahela river.—Pittsburg, Pennsylvania: during the night of the 10-11th an ice-dam, which had formed in the river, broke at 1.30 a. m.; forty-one flats broke from their fastenings and were carried down the river. The river was full of floating ice on the 31st.

Ohio river.—Portsmouth, Ohio: on the 6th the river was filled with floating ice causing suspension of navigation; navigation was resumed on the 30th.

Cincinnati, Ohio: heavy floating ice caused suspension of navigation on the 7th, 8th, and 9th; navigation between the city and points southward was resumed on the 12th; floating ice on the 13th.

Vevay, Indiana: river full of floating ice on the 28th and 31st. For several days preceding the 26th boats were unable to make trips between Evansville, Indiana, and Henderson, Kentucky.

Cairo, Illinois: ice began to form along the shores of the Ohio river on the 14th, and light floating ice was observed on the 5th. A heavy flow of ice continued from the 6th to 18th, 22d, 23d, 25th, 26th and 27th; light ice from the 27th to 31st; the river was clear of ice on the 19th, 20th and 24th. Navigation between Cairo and Paducah, Kentucky, was open during entire month.

Elk river.—Charlestown, West Virginia: the ice in the river broke up on the 12th, resulting in heavy losses to barge owners and lumber men. The losses sustained by the stave and bark dealers alone are estimated at \$100,000.

Tuscarawas river.—Canal Dover, Ohio: river full of floating ice on the 3d; on the 4th river froze over.

Otsego lake.—Cooperstown, Otsego county, New York: ice in lake was eighteen inches thick at close of month.

Lake Erie.—Buffalo, New York: on the 3d floating ice covered the lake for several miles. Traffic on the New York Central railroad was interrupted on account of the tracks being covered with large quantities of ice, washed ashore by the storm of that date.

Saint Clair river.—Port Huron, Michigan: ice formed in the river on the 5th. The steamer "A. D. Conger" was the last boat to arrive at this port. Floating ice on the 6th; river free of ice on the 9th. At 2.30 a. m. of the 15th the ice bridge across the head of the river broke, filling the river with heavy ice and stopping the ferry boats. Subsequently a similar ice bridge formed, which was broken by the high winds of the 19th, with the same results.

Grand river.—Grand Haven, Michigan: the river froze over on the 3d.

Lake Michigan.—Grand Haven, Michigan: the westerly winds of the 23d drove large quantities of ice into the entrance to the harbor, where it was reported to be from twenty to twenty-five feet in thickness. On that date heavy ice-fields, extending lakeward as far as the eye could reach, were observed floating southward. The propellers "Wisconsin" and "Michigan" succeeded in reaching here at noon. Heavy ice-fields continued floating lakeward on the 24th. On the 27th the propellers "Wisconsin" and "Michigan" effected an entrance into the harbor, after having drifted from twenty to twenty-five miles northward with the ice-fields. On that date the ice extended outward a distance of fifteen miles. On the

28th the harbor was comparatively free of ice, but it was again obstructed on the 31st, on which date the ice extended lakeward a distance of twenty miles.

Milwaukee, Wisconsin, 13th: the steamers plying between here and points on the opposite shore were unable to make trips during the past week on account of rough weather and fields of heavy ice. On the 31st steamers reported ice-fields on the lake varying from five to ten miles in width.

South Haven, Michigan: on the 19th a field of ice extended lakeward a distance of ten miles.

Northport, Michigan: lake free of ice on the 31st.

Grand Traverse bay.—Traverse city, Michigan: bay frozen over on the 15th.

Straits of Mackinac.—Mackinaw City, Michigan: the steamer "Algoma," in attempting to cross the straits on the 3d, became fast in the ice when near the middle of the straits, where the ice was from one to three feet thick; she reached Saint Ignace on the 14th, and in attempting to return on the 15th became fast in the ice in the centre of the straits. She arrived here on the 18th, and reported the ice to be from fifteen to twenty feet thick in the channel.

Mississippi river.—Keokuk, Iowa: the river continued frozen here, and at all points northward, throughout the month. At La Crosse, Wisconsin, the ice was reported to have been twenty-four inches thick on the 9th.

Cairo, Illinois: floating ice ran in the Mississippi on the 1st, 2d, and 3d; the river froze over on the 4th and remained frozen after that date.

Memphis, Tennessee: drift ice in river on 3d, 4th, 7th to 13th, 15th, 17th, 18th, 19th. Ice formed along the shores on the west bank of the river on the 6th.

Saint Louis: the river was clear of ice on the 1st; from 2d to 7th it was full of floating ice; from 8th to 18th ice-dams obstructed parts of the harbor; from 19th to 29th the entire harbor was obstructed; on the 30th and 31st ice-dam broke up, resulting in but little damage.

Vicksburg, Mississippi: the steamer "W. P. Thompson" encountered large quantities of drift ice at Illawara, about thirty-four miles north of this place, on the morning of the 5th, and was compelled to return to this city. Large quantities of floating ice passed here during the 12th and 13th.

Missouri river.—Leavenworth, Kansas: on the 5th loaded wagons crossed the river on the ice, which was ten inches thick. The ice became unsafe for crossing teams on the 29th. On the 31st the ice was still intact.

Lexington, Missouri: the ice in the river was eight inches thick on the 3d.

Kansas river.—Manhattan, Kansas: ice in the river was ten and one-half inches thick on the 7th.

James river.—Richmond, Virginia: navigation was interrupted to some extent by ice on the 8th.

Cumberland river.—Nashville, Tennessee: floating ice on the 9th and 10th.

Tennessee river.—Chattanooga, Tennessee: floating ice on the 8th and 9th. On the latter date the heavy floating ice impeded navigation, and the broken ice accumulated along the shore in large quantities.

Knoxville, Tennessee: the river froze over one mile above the city on the 7th; floating ice on the 8th.

Tallapoosa river.—Montgomery, Alabama, 30th; it is reported that during the late cold weather more ice formed in the Tallapoosa river than has been known for many years.

The director of the "Tennessee Weather Service," in his January report, states:

The Forked Deer river was reported frozen over at Dyersburg on the 5th; ice remained until the 24th. The Elk river was frozen over near Fayetteville on the 7th, sufficient for skating. The Ocoee river froze over on the 7th and 8th.

Red river.—Shreveport, Louisiana: floating ice on the 8th.

Rio Grande river.—El Paso, Texas: the river froze over on the 1st.

Arkansas river.—Fort Smith, Arkansas: floating ice on 1st,

2d, 3d, 11th, 13th, 20th, 21st, 24th, 25th. On the 11th an ice-dam which had formed on the river broke, and resulted in the sinking of the steamer "Fort Smith," and caused other damage.

Little Rock, Arkansas: floating ice on 3d and 5th; ice-dam on 6th. The river was frozen from the 7th to 13th.

Miscellaneous.—Lynchburg, Virginia: ice on the streams in this vicinity was four inches thick on the 9th.

Brevard, Transylvania county, North Carolina: the creeks in this vicinity were frozen on the 6th.

FLOODS.

Ellicott City, Howard county, Maryland.—The heavy rain on the night of the 8-9th (during the passage of low area iv.), caused the streams throughout this county to rise to an unusual height for this season of the year. At Oakland Mills the water covered the roadway to a depth of four feet, rendering travel almost impossible and causing delay of mails. The bridge over the Middle Patuxent river is reported to have been carried away.

Red Bank, Monmouth county, New Jersey.—The freshet on the night of the 8-9th caused much damage to the bridges over the Shrewsbury river at this place. A stone pier of an iron bridge was swept away. Bridges were also carried away at Newman Springs, Swimming River, and Hart's Mills.

Fredericksburg, Virginia, 9th.—A destructive freshet has occurred in the Rappahannock river. Several thousand railroad ties, and much other property, was swept away from the wharves.

HIGH TIDES.

Narragansett Pier, Rhode Island.—The severe southeasterly storm of the 9th (low area iv.) caused very high tides, which resulted in serious damage along the sea front. From twenty to thirty large bathing houses were damaged to a more or less extent, and the McSparran hotel grounds and dock were almost completely washed away. The engine-house on Lucker's dock was also washed away and the wharf badly damaged. The sea broke over the banks in places from the mouth of Narragansett bay to Point Judith, causing great damage to roadways and fencing.

Point Judith, Rhode Island.—The heaviest surf and highest tide known here for several years occurred on the 9th (during low area iv.), causing much damage to fences, walls, and small boats.

New London, Connecticut.—The high tides of the 9th (during low area iv.) submerged the Shore Line railroad track, and caused numerous washouts. This road was built in 1853, and was never before submerged by high tides. Several wharves in this vicinity were carried away and completely wrecked. Great damage was done at Osprey Beach, a summer resort about one mile south of station. All of the cellars in the lower part of New London were flooded. The damage in this vicinity resulting from the storm and high tides is estimated at \$150,000.

Block Island, Rhode Island.—The heaviest sea known for many years accompanied the storm of the 9th (low area iv.). Slight damage was caused by the sea washing over the seawall. Vessels in the harbor dragged anchor, and the United States Coast Survey tide-gauge was completely ruined. The tide ran into Great Pond, which is one hundred and fifty yards from the mean high-tide limit.

New Haven, Connecticut.—The high tides of the 2d flooded the cellars along the wharves in this city. The high easterly winds of the 9th (low area iv.) caused the highest tide that has been observed for many years. The Shore Line railroad at West Haven was two feet under water, and the flooring of the bridge over Oyster river was covered. The Long-wharf road bed was badly washed.

Portland, Maine.—On the 9th the high tides broke completely over the breakwater. Many vessels in the harbor were damaged.

Eastport, Maine.—The heavy sea and high tides of the 10th

caused slight damage to small craft in the harbor. Very high tides also occurred on the 12th, 13th, and 14th.

New York City.—The tides of the 9th were the highest known for many years, and resulted in serious damage along the adjacent coast. The following are estimates of the principal losses sustained: Manhattan Beach Marine railroad, \$70,000; Engeman's Pier, \$10,000; property owners along the beach, from \$6,000 to \$7,000.

Atlantic City, New Jersey.—The storm of the 9th (low area iv.) was accompanied by unusually high tides. Nearly four miles of the coast telegraph line were carried away, and other damage caused along the beach.

Baltimore, Maryland.—The brisk southeast to northeast winds of the 8th caused very high tides.

New River Inlet, North Carolina.—Very high tide and heavy sea occurred on the 8th, cutting away the banks and damaging the coast telegraph line.

Hatteras, North Carolina.—Very high tides were caused by the violent southeasterly gale of the 8th (low area iv.).

Fort Macon, North Carolina.—A strong southeasterly gale prevailed on the 8th (low area iv.), causing the tide to rise to a height of four feet above the mean high-tide point. The coast telegraph line was washed down, cutting off communication.

Cedar Keys, Florida.—High tides occurred on the 1st, 8th, 18th, 24th, and 31st.

LOW TIDES.

Galveston, Texas.—The water in Galveston bay was very shallow on the 3d and 24th, owing to "northers."

Indianola, Texas, 8th, 12th, 19th, 20th, 21st.

Cedar Keys, Florida, 8th, 12th, 19th, 20th, 21st.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for January 1884, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 88.85 per cent. The percentages for the four elements are: weather, 92.26; direction of the wind, 87.03; temperature, 88.65; barometer, 87.14 per cent. By geographical districts they are: for New England, 88.27; middle Atlantic states, 91.73; south Atlantic states, 89.92; eastern Gulf states, 91.31; western Gulf states, 89.49; lower lake region, 88.68; upper lake region, 87.50; Ohio valley and Tennessee, 90.59; upper Mississippi valley, 87.87; Missouri valley, 84.27; north Pacific coast region, 83.04; middle Pacific coast region, 84.48; south Pacific coast region, 83.62. There were sixteen omissions to predict, out of 3,813 or 0.42 per cent. Of the 3,797 predictions that have been made, forty-six, or 1.21 per cent., are considered to have entirely failed; ninety-three, or 2.45 per cent., were one-fourth verified; three hundred and thirty-six, or 8.85 per cent., were one-half verified; five hundred and fifty-nine, or 14.72 per cent., were three-fourths verified; 2,763, or 72.77 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During January, 1884, two hundred and forty-one cautionary signals were displayed. Of these, two hundred and eight, or 86.31 per cent were justified by winds of twenty-five miles or more, per hour, at or within one hundred miles of the station. Ninety-four cautionary off-shore signals were displayed, of which number, eighty-six, or 91.49 per cent., were justified as to direction, and seventy-seven, or 81.92 per cent., were justified, both as to direction and velocity. One "northwest" signal was ordered (at Milwaukee, Wisconsin), which was justified as to direction and velocity. Three hundred and thirty-six signals of all kinds were displayed, of which two hundred and eighty-six, or 85.12 per cent., were fully justified. These do not include signals ordered at display stations where the wind velocities are only estimated. Ten signals were ordered late. Of the ninety-four cautionary off-shore signals that were displayed, forty-nine were changed from cautionary signals.

Atlantic
Alpena
Augusta
Baltimore
Block Island
Boston
Buffalo
Canton
Cedar Key
Chicago
Cincinnati
Cleveland
Detroit
Delaware
Duluth
Eastport
Escanaba
Galveston
Grand Haven
Indianapolis
Jackson
Key West
Mackinac
Marquette
Milwaukee
Mobile
New Haven
New London
New York
Norfolk
Pensacola
Portland
Portland
Providence
Sandusky
Sandy Hook
San Francisco
Savannah
Smithville
Toledo, C.
Wilmington

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In forty-five cases winds of twenty-five miles or more per hours were reported from scattered stations for which no signals had been displayed; in the majority of cases fair weather prevailed; in some, the signals had been lowered too soon. No general storm passed over any district without the display of signals beforehand.

Professor T. C. Mendenhall, director of the "Ohio Meteorological Bureau," in his report for January, states:

Railroad signals during the month of January have been carefully observed at Millersburg, and have been found to be verified both as to temperature and rainfall in 83 per cent. of the predictions. Through the kindness of Mr. Affleck, general ticket agent of the Cleveland, Mount Vernon and Delaware railroad, a considerable number of new "testing stations" have been established, and a more complete report will be made up for the month of February.

The signals above referred to consist of colored symbols displayed from the sides of the baggage cars, representing the daily forecasts, as telegraphed at midnight from the office of the Chief Signal Officer to said bureau.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors during January, 1884, with the average depth at which the observations were made, and the mean temperature of the air at the various stations, are given in the table below. The highest water temperature reported during the month, 75° 7, was observed at Key West, Florida; the lowest, 29° 5, was reported from Portland, Maine. Observations were interrupted by ice as follows: Boston, Massachusetts, 7th, 8th, 28th; Grand Haven, Michigan, from 3d to 31st; Chincoteague, Virginia, 6th, 7th, 8th; Cleveland, Ohio, from 3d to 31st.

Temperature of water for January, 1884.

STATION.	Temperature at bottom.		Range.	Average depth, feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey.....	42.0	30.0	12.0	4 9	29.2
Alpena, Michigan.....					12.7
Augusta, Georgia.....	51.5	36.0	15.5	9 4	43.4
Baltimore, Maryland.....	36.0	30.0	6.0	9 11	32.0
Block Island, Rhode Island.....	39.7	29.8	9.9	8 2	29.5
Boston, Massachusetts.....	31.5	29.7	1.8	22 10	23.8
Buffalo, New York.....					18.0
Canby, Fort, Washington.....	50.0	37.9	12.1	17 8	42.6
Cedar Keys, Florida.....	68.6	37.5	31.1	11 4	51.6
Charleston, South Carolina.....	56.1	44.3	11.8	40 1	46.6
Chicago, Illinois.....					19.2
Chincoteague, Virginia.....	44.0	31.3	12.7	5 3	32.7
Cleveland, Ohio.....	32.9	32.1	0.8	14 0	19.3
Detroit, Michigan.....					21.4
Delaware Breakwater, Delaware.....	41.2	30.8	10.4	8 10	31.1
Duluth, Minnesota.....					5.3
Eastport, Maine.....	39.3	33.3	6.0	15 11	17.6
Escanaba, Michigan.....					8.6
Galveston, Texas.....	58.4	37.0	21.4	9 8	46.7
Grand Haven, Michigan.....	32.3	32.0	0.3	19 0	20.9
Indianola, Texas.....	54.5	30.8	23.7	7 9	46.7
Jacksonville, Florida.....	63.5	49.5	14.0	18 0	51.7
Key West, Florida.....	75.7	62.2	13.5	17 8	68.3
Mackinaw City, Michigan.....					13.6
Marquette, Michigan.....					10.9
Milwaukee, Wisconsin.....					13.6
Mobile, Alabama.....	55.3	45.0	10.3	14 2	43.5
New Haven, Connecticut.....	32.1	29.8	2.3	14 3	23.2
New London, Connecticut.....	39.0	33.5	5.5	12 2	26.1
New York City.....	36.3	29.8	6.5	15 11	26.2
Norfolk, Virginia.....	43.5	33.0	10.5	16 2	38.3
Pensacola, Florida.....	59.9	46.6	13.3	16 9	46.4
Portland, Maine.....	32.5	29.5	3.0	16 6	22.4
Portland, Oregon.....	45.4	37.9	7.5	56 3	38.7
Provincetown, Massachusetts.....	37.0	31.0	6.0	11 4	28.5
Sandusky, Ohio.....					20.8
Sandy Hook, New Jersey.....	36.5	34.0	2.5	1 6	27.7
San Francisco, California.....	51.3	49.6	1.7	39 7	50.0
Savannah, Georgia.....	53.3	47.3	6.0	11 7	46.6
Smithville, North Carolina.....	53.4	40.3	13.1	10 0	43.2
Toledo, Ohio.....					20.0
Wilmington, North Carolina.....	48.7	40.3	8.4	20 10	44.3

* Frozen the entire month.

† Observations interrupted by ice; see text.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The director of the "Tennessee Weather Service" reports the following:

An aurora was observed at Huntingdon on the morning of the 21st, and a very brilliant one at Waverly on the 31st.

The only auroral displays reported by the Signal Service observers during the month, occurred on the evenings of the 20th and 25th. The display of the 20th was only observed at Point Judith, Rhode Island, and the observer reports it to have been a faint display lasting from 9.30 p. m. until midnight.

The display of the 25th was observed as follows:

Burlington, Vermont, 25th.—A bright aurora of a pale yellow color, with occasional streamers flashing toward the zenith, from 11.30 p. m. until midnight.

Escanaba, Michigan, 25th.—At 10.15 p. m. an aurora was visible, but cloudiness partially obscured the display. The light was a pale straw color extending upward 25°. No beams were observed.

Fort Buford, Dakota, 25th.—An aurora in the form of "merry dancers" was observed from 9.40 to 11.37 p. m. The display consisted of brilliant white streamers, the outer edges being of a reddish color. The auroral light covered the northern sky from northwest to northeast and to an altitude of 45°.

Poplar River, Montana, 25th.—An auroral light of pale straw color, covering about 45° of the northern horizon, was visible from 9 to 9.25 p. m.

This display was also observed at Cresco and Humboldt, Iowa.

ELECTRICAL PHENOMENA.

Huron, Dakota.—An extensive electrical storm prevailed on the 10th. The telegraph lines along the Chicago and North-western railroad, both east and west, were operated without battery connection.

Capt. J. E. Dutton, of the s. s. "Sardinian," reports on the 26th, at 12.00 p. m. (Greenwich mean time), between N. 54° 58', W. 17° 46' and N. 55° 17', W. 9° 00', atmospheric electricity visible on the mast-heads, yard-arms, and wire stays.

THUNDER-STORMS.

Thunder storms were reported in the various states and territories as follows:

Alabama.—Mobile, 7th.

Arizona.—Fort Apache, 16th, 17th, 18th, 26th; Maricopa, 15th.

Arkansas.—Lead Hill and Little Rock, 30th.

California.—Cape Mendocino, Princeton, and San Francisco, 26th; Hydesville, 26th, 27th; Fall Brook, 28th.

Florida.—Pensacola and Saint Augustine, 7th; Cedar Keys, Jacksonville, Newport, Tallahassee, 24th; Key West, 24th, 25th; Archer, 25th.

Georgia.—Savannah, 8th; Atlanta, 31st.

Illinois.—Cairo, 30th, 31st. During the evening of the 31st brilliant lightning displays were observed near the horizon between west and south. The flashes continued almost incessantly from 6 to 11 p. m.

Indiana.—South Bend, 27th; Fort Wayne, 29th; Griffin Station, Laconia, Logansport, Vevay, and Wabash, 30th.

Iowa.—Burlington, 30th.

Kentucky.—Louisville, 30th.

Louisiana.—Grand Coteau, 7th, 14th; Liberty Hill, 14th.

Michigan.—Hillsdale, Hudson, and Mottville, 30th.

Missouri.—Pierce City, 31st.

North Carolina.—New River Inlet, 1st; Smithville, 1st, 19th; Fort Macon, 8th; Highlands and Ogeeta, 31st.

Ohio.—College Hill and Wauseon, 30th; Jackonsburg, 31st. At Toledo, from 6 to 8 a. m. of the 30th heavy rain showers fell, accompanied by sharp zigzag lightning and heavy peals of thunder. A thunder-storm at this season of the year is of rare occurrence at this place.

Oregon.—Albany, 7th.

Pennsylvania.—Chambersburg, 5th.

South Carolina.—Charleston, 1st, 8th.

Tennessee.—Memphis, 30th, 31st; Ashwood, Chattanooga, Milan and Nashville, 31st.

Wisconsin.—Sussex, 30th.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos have been observed in the various districts on the following dates:

- New England.*—5th to 8th, 13th, 15th, 20th, 23d, 27th.
Middle Atlantic states.—3d, 4th, 5th, 7th, 8th, 10th, 12th, 15th, 17th, 18th, 20th, 23d, 25th, 27th.
South Atlantic states.—5th, 7th, 10th, 11th, 13th, 14th, 16th, 18th, 23d, 24th, 28th, 31st.
Eastern Gulf states.—3d, 4th, 13th, 21st.
Western Gulf states.—2d, 3d, 6th, 9th, 11th, 22d, 26th.
Tennessee.—3d, 13th, 16th, 17th, 27th.
Lower lake region.—4th, 7th, 10th, 12th, 15th, 18th, 22d, 23d, 27th.
Upper lake region.—1st, 2d, 4th, 5th, 7th, 9th to 12th, 15th, 19th, 22d, 25th, 31st.
Extreme northwest.—1st, 3d, 4th, 10th, 11th, 13th, 18th, 30th.
Upper Mississippi valley.—2d to 6th, 9th, 10th, 11th, 13th, 15th, 16th, 17th, 19th, 22d, 24th, 26th, 31st.
Missouri valley.—1st to 5th, 11th, 15th, 17th, 19th, 23d, 26th.
Northern slope.—2d to 6th, 10th, 19th.
Middle slope.—1st, 3d, 4th, 5th, 9th, 10th, 16th, 19th, 21st, 25th, 26th, 30th.
South Pacific coast region.—3d, 4th, 6th, 7th, 10th, 18th, 19th, 24th.
 Solar halos were also observed at the following stations not included in the districts named above:
 Fort Apache, Arizona, 9th.
 Prescott, Arizona, 15th.
 Oakland and Sacramento, California, 7th.
 Carson City, Nevada, 18th.
 College Hill, Ohio, 9th, 15th.
 Roseburg, Oregon, 18th.
 Nephi, Utah, 24th.

LUNAR HALOS.

Lunar halos have been observed in the various districts on the following dates:

- New England.*—4th to 8th, 10th, 12th, 14th to 17th, 31st.
Middle Atlantic states.—3d to 13th, 16th, 17th, 18th, 23d.
South Atlantic states.—2d, 3d, 4th, 6th to 11th, 13th, 14th, 15th.
Eastern Gulf states.—4th, 6th, 7th, 9th, 12th.
Western Gulf states.—5th to 13th, 15th.
Tennessee.—3d, 5th, 6th, 9th, 10th, 13th, 14th, 16th, 17th.
Ohio valley.—3d, 6th, 7th, 9th, 11th to 16th, 18th.
Lower lake region.—7th, 11th, 12th, 22d.
Upper lake region.—3d, 4th, 5th, 7th to 12th, 14th to 17th.
Extreme northwest.—2d, 3d, 4th, 7th, 8th, 10th, 11th, 16th, 31st.
Upper Mississippi valley.—3d to 17th, 19th.
Missouri valley.—1st, 3d, 4th, 9th, 10th, 11th, 13th, 14th, 16th, 23d.
Northern slope.—4th, 7th, 8th, 9th, 11th, 13th, 22d.
Middle slope.—4th, 9th, 13th, 16th, 21st.
Southern plateau.—3d, 5th to 10th, 19th, 20th, 22d.
Middle plateau.—4th to 7th, 11th, 13th.
North Pacific coast region.—7th to 11th, 17th.
Middle Pacific coast region.—7th, 9th, 19th.
South Pacific coast region.—5th, 6th, 7th, 19th.
 Lunar halos were also observed at the following stations not included in the districts named above:
 Cedar Keys, Florida, 3d.
 Lewiston, Idaho, 7th.
 Brownsville, Texas, 15th.
 Fort Davis, Texas, 4th.
 Fort Stockton, Texas, 3d.

MIRAGE.

Sussex, Waukesha county, Wisconsin.—At 7 p. m. of the 7th the hills south of Pewaukee lake appeared in inverted positions at an altitude of three hundred feet.

Webster, Day county, Dakota.—On the morning of the 30th distant objects below the horizon were apparently lifted into the range of vision.

Mirage was also observed at the following stations:

- Pretty Prairie, Kansas, 2d, 9th, 11th, 12th, 13th, 17th, 21st, 22d, 24th, 28th, 30th.
 Genoa, Nebraska, 9th, 12th, 22d, 25th.
 Indianola, Texas, 6th, 8th, 9th, 14th.

MISCELLANEOUS PHENOMENA.

The phenomenal sunrises and sunsets, so extensively reported during the previous months, were also observed during January. From the reports received, it appears that, upon the whole, the displays of January were not so brilliant as those of October, November, and December, although some observers report that those occurring in January were the most brilliant seen at any time since the first appearance of the phenomenon. The reports at hand show the general characteristics of the January displays to be the same as those of the past months, heretofore published in the REVIEW.

In the following summary are given, principally, the dates on which the phenomenon was observed in the several states, with brief descriptions of some of the more important displays:

Alabama.—Auburn: red skies on the evenings of the 20th, 21st, 22d.

Mobile: at sunset, and for one hour thereafter, on the 20th, the eastern horizon was of a bright red color, extending upward 35°. In the west the light rose to an altitude of from 60° to 80°. The colors were so bright that the reflection caused white buildings to assume a pink shade. This display was, by far, the most brilliant of the many beautiful sunsets observed during the last three months. The colors in the western sky remained for more than one hour, and then gradually faded away.

Arizona.—Fort Bowie: red sunsets on the 4th and 12th; on the 27th a brilliant, red light remained visible in the western sky for two hours after sunset.

Arkansas.—Lead Hill: the brilliant sunsets observed since September, were also observed on January, 3d, 24th, 28th, and 31st, the displays becoming less brilliant toward the last of the month.

Little Rock: the sky was of lurid color to an altitude of 80° after sunset on the 2d.

Fort Smith, 22d: the western horizon, though partially obscured by the clouds, was illuminated with red, in places. On the morning of the 26th one-fourth of the eastern sky was of a beautiful red color.

California.—Hydesville, Humboldt county: red skies at sunset from the 10th to 17th, 19th, 21st, 23d, 26th, 28th, 29th, 30th; and at sunrise on 12th, 14th to 17th, 22d, 30th. The unusual colors in the sky before sunrise and after sunset continued on the dates given above, the displays on evenings of the 14th and 15th being the brightest.

Fall Brook: bright after-glow on the 12th. On the 13th, while the usual sunset glow was fading, an arc of salmon color formed above it at an altitude of 25°, from which streamers radiated to an altitude of 45°. A band of pale indigo color separated it from the normal sunset glow beneath, giving the display the appearance of the aurora. The arc rapidly moved toward the horizon, and a second arc formed above it at an altitude of 35°, which sent out streamers, pointing downward toward the common centre and nearly meeting those still visible on the lower arc. The phenomenon was of short duration having disappeared twenty minutes after sunset, leaving the western horizon illuminated with a uniform tint which continued for one hour.

Oakland: bright sunrises and sunsets were observed during the entire month.

Los Angeles: bright sunsets, 16th to 19th, 21st, 22d, 23d.

Colorado.—Golden: beautiful, glowing tints were observed in the eastern and western skies before and after sunset during the greater part of the month.

Fort Collins: red sunsets, 12th, 15th, 16th, 17th; red sunrises, 17th, 21st, 22d, 28th, 29th.

Dakota.—Yankton: at sunset on the 12th the entire western sky was tinged with yellow, and on the evenings of 20th and 27th about four-tenths of the sky was tinged with the same color.

Bismarck, 21st: for two hours after sunset the sky presented a red appearance; on the 23d the sky was of a bright red color for one and one-half hours after sunset.

Fort Totten: red sunsets, 20th, 21st.

Alexandria: rosy sunsets, 16th, 20th, 21st, 28th; rosy sunrises, 17th, 21st, 24th.

Florida.—Archer: red sunrises, 1st, 3d; red sunsets, 3d, 6th, 13th, 18th, 19th.

Newport: red sunsets, 5th, 7th, 20th, 30th.

Jacksonville: very brilliant sky at sunset on the 6th and 12th.

Pensacola: at sunset of the 12th one-fourth of the western sky was of a bright red color; 20th, the whole western sky assumed a succession of tints; the eastern sky before sunrise, and the western sky after sunset, on the 21st exhibited a variety of luminous colors.

Georgia.—Andersonville, Sumter county: unusually bright sunsets on the 3d, 22d, 23d, 27th, 29th, the sunrises of 22d, 23d, and 27th being of similar appearance.

Augusta: brilliant evening twilights on the 19th, 20th, 29th, and 30th.

Illinois.—Rockford: red glow at sunrise and sunset on all clear days of the month.

Cairo: remarkably bright sunsets on 20th, 21st, 24th.

Indiana.—Fort Wayne: beautiful sunset on the 8th.

Sunman: red sunsets on all clear days of the month.

Indian Territory.—Cantonment: a pinkish haze extending to an altitude of 45° from the western horizon was observed on the evening of the 4th.

Iowa.—Independence, 17th: brilliant red light in the east before sunrise, first changing to yellow and then to green, brilliant sunset on same date.

Cresco: red sunrises and sunsets on 15th and 17th.

Muscataine: red sunsets, 8th, 15th, 17th, 20th, 24th, 25th, 26th; red sunrises, 3d, 9th, 17th, 26th.

Oskaloosa: red sunsets, 12th, 15th.

Davenport: deep red colors in western sky at sunset of 10th.

Kansas.—Wellington: the display following sunset was observed throughout the entire month, the glow increasing in brilliancy from the 18th to 25th.

Allison: unusually brilliant sunset glows on 1st, 13th, 22d. Pretty Prairie, Reno county: red skies after sunset, 2d, 10th to 16th, 19th to 24th, 27th, 29th.

Kentucky.—Bowling Green: brilliant sunsets during greater part of the month.

Maine.—Eastport: on the evenings of the 5th and 6th, a red glow was visible in the western sky for one hour after sunset.

Cornish: bright sunsets, 5th, 6th, 7th.

Massachusetts.—Somerset: red sunsets, 9th, 17th, 26th; red sunrise, 10th.

Taunton: ruddy sunsets, 17th, 24th, 28th.

Princeton: red sunset, 21st.

Michigan.—Grand Rapids: gaudy sunsets on every clear day during the month.

Manistique: sky very red for one hour after sunset on 7th; very brilliant on 31st.

Lansing: brilliant sunset, 8th.

Minnesota.—Hastings: brilliant sunrises and sunsets of yellow, rose, and red colors were observed on all clear days of the month.

Saint Paul: unusually bright sunsets on 10th, 21st.

Saint Vincent: bright sunset displays on 19th, 20th, 21st.

Nebraska.—Red Willow: bright red glow before sunrise on 9th, 12th, 20th, 21st, 28th; and after sunset on the 12th.

Stella: red sunsets on 15th, 16th.

North Platte: beautiful sunrises on the 24th, 28th, and 29th. **New Jersey.**—Barnegat City: the sunset of the 3d surpassed in brilliancy any that have been previously observed.

New Mexico.—Fort Stanton: a reddish glow in the western sky at sunset on the 8th and 11th.

New York.—North Volney: bright sunset displays, 2d; and at Auburn on 6th and 17th.

North Carolina.—Brevard: brilliant twilights on 9th, 12th, 19th, 22d, 25th, to 29th.

Ohio.—Portsmouth: beautiful sunsets on 5th, 20th, 21st.

Wauseon: brilliant sunrise and sunset on 20th.

Sandusky: bright, red sunset on 13th.

Oregon.—Lake View: bright, red sunset, 15th, 22d.

Pennsylvania.—Leetsdale: the peculiar redness of the sky after sunset was frequently observed during the month.

Quakertown: red sunsets, 17th, 20th, 25th, 26th, 28th.

Tennessee.—Knoxville, 26th: the western sky was unusually red at sunset. This phenomenon has been observed on every clear evening for the last two months, but the display of this date was the most brilliant observed during that time.

Chattanooga: 9th, brilliant sunrise; 20th, brilliant sunset.

Nashville: very bright sunsets on 12th, 20th, 21st, 29th; very bright sunrises on 13th, 30th.

Austin: remarkably red sunset on 5th.

Texas.—Galveston: beautiful sunsets were observed on the 19th and 20th, on the latter date the eastern sky before sunrise presented the same peculiarities.

Utah.—Salt Lake City: the sunset of the 16th was very beautiful; an intense glow of bright red overspread the sky, which continued for several minutes after sunset.

Vermont.—Strafford: red sunsets on the 25th, 26th; red sunrise on 27th.

Virginia.—Lynchburg: brilliant sunsets on 19th, 21st, 29th.

Washington Territory.—Bainbridge Island: beautiful sunsets 13th, 14th, 31st.

Olympia: after sunset on the 13th the western sky was of a fiery red color.

Wisconsin.—Wausan: on clear days before sunrise, and after sunset, an unusual light appeared in the skies. The phenomenon usually made its appearance in the morning about three-fourths of an hour before sunrise, the sky assuming an orange color, which gradually faded into a yellow light.

Manitowoc: beautiful sunsets on nearly every evening, the colors sometimes extending over nearly the whole horizon.

Sussex: green sunrise on 7th; red sunset on 15th.

La Crosse, 30th: the western sky was of deep red color at sunset, while at the same time the eastern sky was of a deep purple. These colors were visible for more than one hour.

Wyoming.—Cheyenne: very bright sunsets were observed on the 12th and 15th.

SUN SPOTS.

Professor David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for January, 1884:

Date— Jan., 1884.	No. of new		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
3, 12 m....							7	50 $\frac{1}{2}$	
4, 10 a. m....	2	10 $\frac{1}{2}$	1	5	2	10 $\frac{1}{2}$	5	55 $\frac{1}{2}$	
4, 1 p. m....	0	0	0	0	0	0	8	55 $\frac{1}{2}$	
5, 3 p. m....	1	5 $\frac{1}{2}$	1	2	1	5 $\frac{1}{2}$	8	60 $\frac{1}{2}$	
6, 1 p. m....	0	10 $\frac{1}{2}$	0	0	0	0	9	70 $\frac{1}{2}$	
10, 9 a. m....							9	120 $\frac{1}{2}$	
16, 8 a. m....							5	40 $\frac{1}{2}$	
17, 2 p. m....	0	5 $\frac{1}{2}$	1	1	0	0	4	45 $\frac{1}{2}$	
20, 10 a. m....							5	45 $\frac{1}{2}$	
21, 10 a. m....	0	0	2	5 $\frac{1}{2}$	0	0	3	35 $\frac{1}{2}$	
22, 8 a. m....	1	1	0	0	1	1	4	35 $\frac{1}{2}$	
23, 10 a. m....	1	2	0	10 $\frac{1}{2}$	1	2	5	30 $\frac{1}{2}$	
26, 8 a. m....	2	25 $\frac{1}{2}$					5	40 $\frac{1}{2}$	
27, 11 a. m....	1	5	0	0	1	5	0	45 $\frac{1}{2}$	

Faculae were seen at the time of every observation. †Approximated.

Mr. H. D. Gowey, of North Lewisburg, Champaign county, Ohio, reports that during January, 1884, sun spots were least

numerous on the 3d; most numerous on 25th; largest on the 31st, and smallest on the 1st.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and sixty stations show 4,901 observations to have been made, of which six were reported doubtful; of the remainder, 4,895, there were 4,184, or 85.5 per cent., followed by the expected weather.

EARTHQUAKES.

Portland, Oregon.—A light shock of earthquake occurred at 8.40 p. m. of the 3d. Its duration was about two seconds; vibration from southeast to northwest.

Los Angeles, California.—At 11.56 a. m. of the 4th a slight shock of earthquake was felt. Owing to its short duration the vibration was not determined.

Wilmington, North Carolina.—A slight shock of earthquake was felt at about 8 a. m. of the 18th. The shock was very perceptible, causing crockery, etc., to shake. Reports from Fort Macon and Beaufort state that the shock was also felt at those places but somewhat earlier than at this place. The duration of the shock at Wilmington is estimated at from eight to thirty seconds.

New River Inlet, North Carolina.—Two distinct shocks of earthquake were felt in this vicinity at 8.30 a. m. of the 18th. The shocks were separated by an interval of about two minutes, and were sufficient to displace crockery and to cause buildings, trees, etc., to vibrate.

Fert Macon, North Carolina.—At about 7.50 or 7.55 a. m. of the 18th two slight shocks of earthquake were felt here and at Beaufort. The direction of the shocks was from southwest to northeast. They were of from three to four seconds duration and accompanied by a rumbling sound.

Contoocook, Merrimac county, New Hampshire.—A violent earthquake shock occurred at 2 a. m. of the 18th. It was felt throughout this region.

Hydesville, Humboldt county, California.—Two shocks of earthquake occurred on the 27th. The first, a sharp shock, was felt at 11.30 p. m., and the second, a very light one, followed about five minutes later. They were preceded and followed by a roaring sound.

Eureka, Humboldt county, California.—A severe shock of earthquake was felt in this city at 11.30 p. m. of the 27th. The vibrations, which were somewhat prolonged, were from north to south.

Cape Mendocino, California.—A severe earthquake occurred at 11.30 p. m. of the 27th. Three shocks were felt, the interval between the first and second being only an apparent lull, while six minutes intervened before the third shock occurred. The second shock was the most violent, being sufficient to shake buildings perceptibly and to displace light articles, etc. The direction was reported by some persons to be east and west, while to others it appeared to be north and south.

Saint John, New Brunswick.—Three distinct shocks of earthquake were felt at Rothesay, about nine miles from here, on the 29th.

The following extract is taken from the "New York Tribune" of January 27, 1884:

WASHINGTON, January 26.—Assistant George Davidson telegraphs the superintendent of Coast and Geodetic Survey, from San Francisco, that at 7 hours and 24 minutes last evening earthquake waves were indicated by the delicate levels of the astronomical instruments of the observatory. The amplitude of each vibration was three seconds of arc, in six seconds of time, and they continued for twenty minutes.

METEORS.

Variety Mills, Nelson county, Virginia.—At 10.45 p. m. of the 2d a meteor was observed moving slowly from the head of "Ursa Minor" in a southwesterly direction at an altitude of about 35°. It was visible about eight seconds and left behind it a trail of light, its path being about 80° in length.

Los Angeles, California.—At 8.17 p. m. of the 6th a bright meteor shot across the sky in a northeasterly direction, leaving a trail of bright light. At its disappearance no cloud was seen or explosion heard.

Saint Vincent, Minnesota.—On the evening of the 21st a meteor was observed in the northern sky. It made its appearance at 7.30 p. m., and during its flight changed its brilliancy, first fading and again becoming very bright. It passed from east to west, and was followed by a cloud at its disappearance.

Little Rock, Arkansas.—A very brilliant meteor of violet color, passing from southeast to northwest, was observed during the evening of the 25th.

Mobile, Alabama.—A large meteor, moving rapidly in a southerly direction from a point a little north of the zenith, was observed at 5.40 p. m. of the 6th. When near the horizon it exploded into many fragments, but no report was heard. The meteor was apparently about two-thirds the size of the full moon, and the light produced was sufficiently bright to cast shadows.

Meteors were also observed at the following places:

- 2d and 3d.—Lead Hill, Arkansas.
- 16th.—Mountainville, New York; Taunton, Massachusetts.
- 17th.—Davenport, Iowa.
- 20th.—Crete, Nebraska; Woodstock, Maryland.
- 21st.—Lead Hill, Arkansas.
- 22d and 23d.—Portland, Maine.
- 24th.—Manhattan, Kansas.
- 25th.—Readington, New Jersey.
- 26th.—Mobile, Alabama.
- 28th.—Lead Hill, Arkansas.
- 30th.—Brevard, North Carolina; Wytheville, Virginia.

ZODIACAL LIGHT.

- Prescott, Arizona, 23d, 27th.
- Webster, Dakota, 1st to 8th, 10th, 13th, 14th, 20th, 21st, 23d, 24th, 25th, 27th, 28th, 30th, 31st.
- Archer, Florida, 14th, 15th, 18th, 19th, 22d, 31st.
- Wabash, Indiana, 24th.
- Cresco, Iowa, 14th, 15th, 23d, 24th.
- Humboldt, Iowa, 19th.
- Allison, Kansas, 20th, 21st, 23d, 24th, 26th.
- Cambridge, Massachusetts, 16th, 18th, 21st, 26th, 27th.
- Rowe, Massachusetts, 25th.
- Escanaba, Michigan, 3d, 5th, 7th, 14th, 20th, 23d, 24th, 26th, 31st.
- Brevard, North Carolina, 19th, 22d, 26th, 28th.
- Albany, Oregon, 21st, 22d, 23d, 29th, 30th, 31st.
- Haverford College, Pennsylvania, 17th, 26th.
- Point Judith, Rhode Island, 26th.
- Stateburg, South Carolina, 20th, 21st, 26th, 30th.
- Nashville, Tennessee, 13th, 20th, 21st, 22d, 26th, 29th.
- Variety Mills, Virginia, 21st, 22d.
- Sussex, Wisconsin, 17th to 24th.

POLAR BANDS.

- Lead Hill, Arkansas, 2d, 5th, 8th, 12th, 20th, 21st.
- Los Angeles, California, 2d, 3d, 8th.
- Archer, Florida, 2d, 4th, 2th, 17th, 19th, 31st.
- Guttenberg, Iowa, 14th.
- Yates Centre, Kansas, 5th, 11th, 23d, 31st.
- Gardiner, Maine, 13th, 25th.
- Escanaba, Michigan, 16th.
- Clear Creek, Nebraska, 26th.
- North Platte, Nebraska, 29th.
- Moorestown, New Jersey, 4th.
- Vineland, New Jersey, 12th, 13th.
- Wauseon, Ohio, 4th, 7th, 13th, 17th, 22d, 24th, 25th, 26th.
- Portland, Oregon, 15th.
- Nashville, Tennessee, 13th.
- Rio Grande City, Texas, 12th.
- Variety Mills, Virginia, 2d.
- Wytheville, Virginia, 3d, 6th, 10th.

MIGRATION OF BIRDS.

Geese flying southward.—Mobile, Alabama, 14th; Cairo, Illinois, 5th, 23d, 24th, 28th; Fort Madison, Iowa, 30th; Yates Centre, Kansas, 3d; New River Inlet, North Carolina, 2d; Point Judith, Rhode Island, 5th. *Flying northward.*—Red Bluff, California, 19th; Holton, Kansas, 29th; Leavenworth, Kansas, 13th; Portland, Oregon, 27th. *Flying eastward.*—Manhattan, Kansas, 5th. *Flying westward.*—Yates Centre, Kansas, 17th.

Ducks flying northward.—Sacramento, California, 13th, 15th to 18th; Cantonment, Indian Territory, 3d; Holton, Kansas, 29th; Indianola, Texas, 30th, 31st. *Flying southward.*—Mobile, Alabama, 4th.

Brents flying northward.—Indianola, Texas, 31st.

DROUGHT.

Red Bluff, California, 31st.—It is estimated that the recent rains benefited this county alone to the extent of more than \$500,000. Before the rains many farmers had stopped ploughing and seeding on account of the drought. Sheep raisers were compelled to kill the young lambs, there not being sufficient water for both the sheep and lambs. The late rains have insured good crops of grain and wool.

PRAIRIE AND FOREST FIRES.

Cantonment, Indian Territory, 13th.
Reno, Indian Territory, 13th.
Dodge City, Kansas, 13th.
Fort Stockton, Texas, 27th, 29th.
Indianola, Texas, 20th.

NOTES AND EXTRACTS.

Hon. A. J. McWhirter, Commissioner of Agriculture for Tennessee, and director of the weather service of that state, in his report for January, 1884, furnishes the following:

The following report is based on returns from forty-three (43) stations, distributed as follows: Twelve in the eastern, nineteen in the middle, and twelve in the western division.

The mean temperature for the month was 29°.45, 13°.42 below that for December, and several degrees below the January mean of many years past. Indeed, a generally lower temperature has not been recorded for the past twenty years. The lowest point recorded was 16° below zero, at Knoxville. As low as 14° below zero was reported from two other stations, the general minimum being from 5° to 10° below zero. The maximum temperature during the month was 74°, reported from Darnall, in Lake county. The range of temperature was 90°, the greatest during the year, and 24° greater than that for December.

The highest temperature was recorded about the 1st and 30th, and the lowest about the 5th, 6th, and 25th.

The mean depth of rainfall was 6.55 inches, 2.24 inches greater than that for December. This amount appears small when the number of rainy days and the depth of snow are considered. It is much smaller than the precipitation of January, 1882, which was almost unprecedented. The month was one of rain and snow, only four or five days being reported without rainfall in some parts of the state. The days on which rains were general were the 1st, 7th, 11th, 14th, 18th, 19th, 23d, 24th, and 31st. The heaviest rainfalls occurred on the 31st, 14th, and 24th, in the order named. The greatest precipitation was 14 inches, reported from McMinnville, and the least was only .80 of an inch, reported from Darnall. There may be some slight inaccuracies in the measurement of the fall of snow in some instances, on account of the want of proper care being taken in measuring the actual depth of the snow and in melting it. By reference to the "Instructions to Observers" it will be seen that no little care is required to make an accurate measurement.

The feature of the month was the unusual amount of snow-fall, the fall at some stations being as much as 22 inches. The first and heaviest fall of the month was in the early part—about the 5th–7th—and was accompanied by the abnormally low temperature. The average depth of the fall during the month was 11.71 inches, the greatest that has been recorded for many years.

The ground was frozen throughout the state on several days during the month. Special mention was made from Dyersburg on the 5th, 6th, and 7th, of 4 inches; at McKenzie, 14 inches on the 26th, at which time ice formed in the centre of oak trees sixteen inches in diameter; at Hurricane Switch, on the 3d to the 14th, inclusive; the 16th and 17th; the 19th to the 23d, inclusive; the 25th to the 29th, inclusive; at Howell, on the 7th, 4.50 inches; at Florence Station, on the 6th, 4 inches; at Riddleton, on several days, the depth varying from 1.50 to 13 inches, the latter on the 6th; and at Grief, on the 5th and 6th.

A new table has been introduced in this report, and will be a feature in future reports, giving the daily rainfall at each station during the month;

also a table of the rainfall and temperature at the four principal stations in the state for the month of January for a number of years past. These tables will no doubt prove valuable for reference, and observers are specially requested to note carefully the days on which the rainfall occurs; also the exact amount of the fall each day.

The Commissioner is gratified to announce that, through the kind co-operation of Gen. W. B. Hazen, Chief Signal Officer, he has been able to procure a number of rain gauges to be distributed throughout the state, thereby securing in the future a more accurate estimate of the precipitation each month.

Average number of clear days, 5.4.

Average number of fair days, 7.

Average number of cloudy days, 18.6.

Average number of days on which rain or snow fell, 10.8.

Prevailing direction of wind, north.

The following extract is reprinted from the January report of the "Ohio Meteorological Bureau," Professor T. C. Mendenhall, director:

The meteorological conditions during the month were, on the whole, quite exceptional. The maximum barometric height was reached at Canton on the 26th, the record being 30.83 inches. This is the highest reading reported to the bureau since its organization. The range of the barometer was greater than for any month of the past year.

The precipitation was also considerably in excess of that of last year, much of it being in the shape of snow. In some portions of the state the depth of snow was unusual. In Marietta it was twenty-two inches, which is reported as being the deepest snow since the year 1818.

But the most remarkable feature of the weather of the month was the extremely low temperature which was reached on several days and at nearly all observing stations. The mean temperature for the month for the entire state was 19°.4, being nearly 5° lower than for January of last year. The maximum temperature observed, at Cincinnati on the 30th, was 59°.7, being only slightly less than the maximum for the same month of last year. The minimum temperatures recorded on several occasions were much lower than any of last year. There were three distinct and severe depressions of temperature during the month. The first began about the 3d and lasted four or five days. During at least two days of these every observer reported temperatures below zero. The greatest cold of this wave was on the 6th, the minimum observed at Wauseon being 24°.6 below zero; the mean minimum over the whole state was 15°.8 below zero. The second cold wave was of shorter duration, and showed its strength on the 21st. Although the depression was greater than in the first, this second wave was more limited in its area, being restricted in its severity to a belt running east and west through the central part of the state. The mean minimum was, therefore, not equal to that in the first case, being 11°.1 below zero. The lowest temperature observed was 31° below zero at the Ohio State University. The third wave began to be felt in the northern and western portions of the state on the 24th, and reached its greatest severity on the 25th at nearly all stations, but in one or two instances the minimum was not reached until the 26th. This was much the most remarkable depression of the month. The mean minimum was 19°.8 below zero; the lowest point was reached at Sidney. Some of the extreme temperatures reported on the 25th were as follows: Sidney, -34°; Ohio State University, -32°; Wauseon, -31°.7; Junction, -30°.5; Levering, -29°.2; Logansport, -29°; Westerville, -28°. It is believed that these temperatures are entirely unprecedented in the history of this state, there being no meteorological records known to the writer which show such extreme cold in Ohio. Mr. Mikesell, who has observed for many years at Wauseon, which easily ranks as the coldest station in the state, reports that the lowest temperature ever known there previous to that of the 25th was 29°.2 below zero, observed January 29, 1873.

SUMMARY OF REPORTS FOR THE STATE.

Mean, barometer 30.20; highest barometer, 30.83, on the 26th, at Canton; lowest barometer, 29.48, on the 2d, at Wauseon; range of barometer, 1.35.

Mean relative humidity, 82.6 per cent.

Mean temperature, 19°.4; highest temperature, 59°.7, on the 30th, at Cincinnati; lowest temperature, -34°.0, on the 25th, at Sidney; range of temperature, 93°.7; mean daily range of temperature, 18°.9; greatest daily range of temperature, 48°, on the 25th, at Sidney; least daily range of temperature, 2°.1, on the 1st, at Cincinnati.

Average number of clear days, 6.4; fair days, 8.2; cloudy days, 16.4; days on which rain fell, 14.

Mean monthly rainfall for the state, 2.72 inches; average daily rainfall, 0.09 inch; greatest monthly rainfall, 5.61 inches, at Marietta; least monthly rainfall, 1.39 inches, at Junction.

Prevailing direction of the wind, southwest.

The above summary is compiled from the reports of observations made at twenty-seven stations.

Mr. S. R. Thompson, director of the "Nebraska Weather Service," furnishes the following report, based upon reports from thirty-two stations:

BULLETIN FOR JANUARY, 1884.

Rainfall.—The average by sections was as follows: Southeast, 0.64 inch; northeast, 0.88 inch; southwest, 1.22 inches; northwest, 0.38 inch.

Temperature.—The mean temperature of the air was 18°. The average of all noon observations was 25°.4.

The mean temperature and average precipitation for the state was about the normal for January.

The following extract is taken from the San Francisco "Daily Alta Californian," of January 16, 1884, preceding the heavy rains which fell during the latter part of the month in California:

These halcyon days which have greeted us week after week thus far, since the beginning of the so-called rainy months—this continuous period of sunshine, until now far into the middle of the "rainy season," hardly broken by a rainfall worthy of the name—brings us face to face with the question of what is in store for us for the year, whether it is to be one of drought, or otherwise.

Speculation upon this question can, of course, accomplish nothing in the adjustment and disposition of the elements, calculated to minister to and relieve our necessities. An analysis of the facts furnished by the history of the annual rainfall in the state since 1849 may, however, furnish a reasonable basis for conclusion as to what is in store for us during the current season of "seed-time and harvest," and prepare us for the possibilities, if not the probabilities, that we are to encounter.

The record of the annual rainfall at Sacramento since 1849 shows with painful exactitude that every sixth or seventh year thus far, in California, has been one of drought. An analysis of these six or seven-year periods shows likewise that the average rainfall in each period has been from 18 to 19 inches per annum. We purpose to carry this analysis a little further, in the full faith that it will prove interesting, if not instructive, reading.

Since 1849, and up to the close of December, 1883, the years in which the aggregate rainfall for the months of September, October, November, and December has been less than three inches, have been as follows:

Year.	Rainfall for Sept., Oct., Nov., and Dec.	Total for season.
1850.....	0.600	4.710
1854.....	2.810	18.620
1855.....	2.750	13.770
1862.....	2.687	11.579
1870.....	1.575	8.470
1878.....	1.566	16.772
1883.....	2.920	

Average rainfall per annum for each of these seasons, 12.32 inches.

The years in which the aggregate rainfall for the same months has been less than four inches were as follows:

Year.	Rainfall for Sept., Oct., Nov., and Dec.	Total for season.
1853.....	3.045	20.065
1856.....	3.242	10.443
1863.....	3.308	7.868
1865.....	3.351	17.924
1868.....	3.386	16.644
1876.....	3.640	9.325
1877.....	3.037	21.249

Average rainfall per annum for each of these seasons, 14.788 inches.

The years in which the aggregate rainfall for these same months was less than five inches were as follows:

Year.	Rainfall for Sept., Oct., Nov., and Dec.	Total for season.
1869.....	4.932	13.572
1879.....	4.043	18.511

Average rainfall per annum for these seasons, 16.041 inches.

The years in which the aggregate rainfall for these months was less than six inches were as follows:

Year.	Rainfall for Sept., Oct., Nov., and Dec.	Total for season.
1860.....	5.540	15.548
1881.....	5.773	16.280

Average per annum for these seasons, 15.914 inches.

The years in which the aggregate rainfall for these months was over seven and less than eight inches were as follows:

Year.	Rainfall for Sept., Oct., Nov., and Dec.	Total for season.
1858.....	7.486	16.041
1872.....	7.530	14.208
1882.....	7.580	18.300

Average per annum for these seasons, 16.183 inches.

We have seen that the average rainfall per annum for the six and seven-year periods between and including the years of drought has been 18 and 19 inches. From the foregoing analysis it appears that in order to reach this average—if the record of preceding years is of any value as precedent—it is necessary that there should be a rainfall in the months of September, October, November, and December of more than 8 inches. Further than this, in no season where the rainfall in these months has been less than 3 inches has the average for the season exceeded 12.32 inches. What, then, is the inference for 1883-4, when the rainfall has only reached 2.92 in September, October, November, and December? True, in 1853-4, when the rainfall in these months was but 2.81 inches, the aggregate for the season was 18.62 inches. This, however, was the only exception to the rule. And, while the present season may also prove an exception, and abundant rains may still come to bless us, yet the other unpleasant fact remains that this is the seventh season since the last one of drought, and if it should prove fairly up to the average it would be the first break in the regular periodicity of drought since 1849.

INDIANA WEATHER SERVICE.

Monthly summary of meteorological observations for January, 1884, made at Purdue University, La Fayette, Indiana; also a review of the State Volunteer Weather Service, compiled from the reports from thirty-two stations, by W. H. Ragan, director.

Latitude 40° 27' north, longitude 9° 54' west of Washington; altitude above sea-level, 661 feet.

	Day of month.	At Purdue University.	Day of month.	In the state.
Barometer—_inches.				
Maximum height.....	26	30.70	26	30.79
Minimum height.....	13	29.67	13	29.54
Mean height.....		30.20		30.07
Monthly range.....		1.03		1.25
Thermometer—degrees.				
Maximum height.....	30	56.0	31	62.0
Minimum height.....	5	-28.0	5	-28.0
Greatest daily range.....	25	32.0	25	37.0
Least daily range.....	28	5.0	1	0.0
Mean of warmest day.....		42.5		48.4
Mean of coldest day.....		-18.0		-16.7
Monthly range.....		84.0		90.0
Monthly mean.....		17.6		20.0
Precipitation—_inches.				
Greatest on any day.....	2	0.50	10	1.80
Maximum.....		1.69		3.13
Minimum.....				0.61
Mean.....				1.68
Wind—miles travelled.				
Maximum velocity.....	2	33		
Mean hourly velocity.....		12		
Total miles for month.....		8,845		

Comments.—The average temperature for January for five years, as recorded at this office, is 25°.1, while the average at Indianapolis for thirteen years is 29°.5. The average temperature of January, 1884, at Purdue University is, therefore, 7°.5 below the average of five years, and for the state, 9°.5 below the Indianapolis average for thirteen years. The following temperatures for January, for five years, as recorded at this office will be of interest in this connection:

Year.	Highest.	Lowest.	Average.	Range.
1880.....	68.0	16.0	41.3	52.0
1881.....	39.0	-15.0	19.1	54.0
1882.....	59.0	1.0	27.9	58.0
1883.....	42.0	-15.0	19.6	57.0
1884.....	56.0	-28.0	17.6	84.0

From the above it will be seen that in two of the years named the temperature did not fall to zero. In 1881 it was below zero on seven different days during the month. In 1883 it was below zero on five days, and in 1884 it was below on eleven days, viz: 3d, 4th, 5th, 6th, 7th, 9th, 16th, 20th, 21st, 24th, and 25th.

The highest temperature (62°) reported for the state is from Crawford county; also the greatest daily range.

The lowest temperature is reported from Tippecanoe county. The coldest day (-21°) from Putnam county. The warmest day (52°) is reported from Spencer county. The least daily range of temperature is reported from Wayne and Switzerland counties. The highest barometer is reported from Vanderburg county; the lowest from Wabash county. The greatest precipitation is reported from Crawford county; the least from Lawrence county. The greatest aggregate depth of snow (18.5 inches) is reported from Warrick county; the least (7.5 inches) from Hamilton county. The average January precipitation at Indianapolis for thirteen years is 2.79 inches; for Purdue University for five years, 2.32 inches.

Average miles of wind recorded for January at Purdue University for five years, 7,356.

The report of the "Missouri Weather Service," as given below, is based upon observations made at twenty-nine stations:

January, 1884, has been unusually cold, with deficiency of precipitation. The average temperature was 22° at the central station, which is 9° below the normal January temperature for Saint Louis, as shown by Doctor Engelmann's series for forty-nine years. The average January temperature was, however, lower than in the past January in 1856, when it fell to 20°, and in 1857, when the mean was 19°. In 1875, also, it was 21°.

In the state the temperature has been, as is usual, much colder than in Saint Louis. The lowest means reported were 17° at Lexington, 17° at Booneville, 17° at Sedalia, and 17° at Oregon, the first three being in central Missouri and the last in the northwestern part of the state.

The lowest temperature recorded in Saint Louis was -23°, which is half a degree colder than the previously observed minimum, in January, 1873. In the state the temperature has fallen still lower. The lowest minimum reported was -33° at Sedalia; Warrensburg and Kirksville reporting -32°; Booneville and Harrisonville, -31°; Miami, -30°, and Savannah, -27°. The highest minimum temperatures reported were -16° at Cairo, Illinois; -23° at Saint Louis, and -24° at Keokuk, Iowa.

The following notes on the cold temperature of the 5th are given by the observers: Saint Charles—the 5th was the coldest ever observed here. Oregon—coldest since January 18, 1857, when the thermometer registered -30°. Louisiana—thermometer stood at -33° on the river bridge. Ironton—coldest weather yet observed here; thermometer read -23°; the coldest heretofore was -17°. Chamois—January, 1875, the thermometer read two degrees lower than in the present month. Clinton—at 7 o'clock, -32°. Steelville—on the 5th, -18°. The observer at O'Fallon reports that on January 29, 1873, the thermometer read -28°, and at Trenton, Saint Louis county, on January 1, 1864, his thermometer read -23°.

The sky glow before sunrise and after sunset has been visible during the month when the clouds did not prevent. The color, however, is somewhat less brilliant than in November and December. At several stations in Europe volcanic dust has been collected from the air identical with that thrown out at Krakatowa, so that the cause for the phenomenon seems to be conclusively settled.

The death of Dr. George Engelmann, which occurred on the 4th of February, is an event which we deplore in common with lovers of science in all lands. He had just entered upon the forty-ninth year of his meteorological observations, and his report for January of the present year was made out after all hope had been abandoned by his physicians. His greatest work was in the field of botany, and an important paper on this subject, upon which he labored until the very last, was not perhaps as fully completed as he desired. It was a worthy ending of a noble life. His report on the temperature of Saint Louis during forty-seven years is just issuing from the press, and will be forwarded to observers and exchanges of the service.

FRANCIS E. NIPHER, Director.

WASHINGTON UNIVERSITY, February 6, 1884.

WEATHER REPORT FOR JANUARY, 1884.

Prepared by Prof. F. H. Snow, of University of Kansas, from observations taken at Lawrence.

In mean temperature only three Januaries in the past sixteen years have been colder than this (in 1873, 1875, and 1883). The minimum temperature of 21° below zero, on the 5th, has been exceeded but once, on January 29, 1873, when the mercury reached 26° below zero. The low mean temperature of the 5th (12° below zero) has also been exceeded but once, on January 28, 1873, when the mean was 14° below zero. The remarkable red skies at sunrise and sunset were observed during the entire month, being nearly as brilliant on the 30th as on any day in November and December.

Mean temperature—20° 99, which is 5° 65 below the January average. The highest temperature was 57°, on the 29th; the lowest was 21° 5 below zero, on the 5th, giving a range of 78° 5. The mercury fell below zero on seven days. Mean temperature at 7 a. m., 14° 09; at 2 p. m., 27°; at 9 p. m., 21° 39.

Rainfall—(consisting of melted snow) 1.28 inches, which is 0.08 inch above the January average. There was no rain. Snow fell on seven days. The entire depth of snow was 12 inches, none of which remained on the ground at the end of the month.

Mean cloudiness—41.42 per cent. of the sky, the month being 1.46 per cent. clearer than usual. Number of clear days (less than one-third cloudy), 16; half-clear (from one to two-thirds cloudy), 7; cloudy (more than two-thirds), 8. There were 7 entirely clear days, and 4 entirely cloudy. Mean cloudiness at 7 a. m., 45.87 per cent.; at 2 p. m., 42.90 per cent.; at 9 p. m., 35.48 per cent.

Wind—southwest, 30 times; northeast, 24 times; northwest, 18 times; west, 11 times; north, 5 times; southeast, 3 times; east, twice. The total run of the wind was 14,368 miles, which is the highest January total upon our record, and is 2,957 miles above the January average. This gives a mean daily velocity of 463.48 miles and a mean hourly velocity of 19.31 miles. The highest velocity was 50 miles an hour, on the 10th.

Barometer—mean for month, 29.313 inches; at 7 a. m., 29.333 inches; at 2 p. m., 29.295 inches; at 9 p. m., 29.311 inches; maximum, 29.881 inches, on the 4th; minimum, 28.735 inches, on the 9th; monthly range, 1.146 inches.

Relative humidity—mean for month, 73.9; at 7 a. m., 85.3; at 2 p. m., 56.7; at 9 p. m., 79.8; greatest, 100, on sixteen occasions; least, 32, on the 13th. There were three fogs.

The following table furnishes a comparison with the sixteen preceding years:

January.	Mean temperature.	Maximum temperature.	Minimum temperature.	Winter days.	Zero days.	Rain (inches).	Snow (inches).	Rainy days.	Thunder-storms.	Mean cloudiness.	Humidity.	Number of fogs.	Miles of wind.	Mean barometer.	Maximum barometer.	Minimum barometer.
1868	23.67	64.0	7.0	23	2	0.36	5.00	1	0	37.00	.....	0	.....	29.101	29.390	28.616
1869	30.50	59.0	6.0	18	0	2.90	4.00	9	0	43.57	83.7	1	.....	29.101	29.390	28.616
1870	29.43	59.3	1.0	20	1	0.67	3.00	6	0	49.25	74.2	1	.....	29.158	29.764	28.191
1871	28.86	57.3	5.0	18	3	1.11	11.00	8	0	64.00	75.7	2	.....	29.199	29.726	28.665
1872	24.35	59.3	7.5	22	4	0.17	1.00	1	0	42.69	68.3	1	.....	29.238	29.697	28.810
1873	18.01	49.3	2.0	24	7	2.60	16.00	9	0	47.10	75.5	1	10,933	29.117	29.704	28.627
1874	28.01	61.0	2.5	18	1	2.35	7.50	8	0	53.65	73.0	2	13,203	29.184	29.845	28.447
1875	15.76	65.5	2.0	13	10	0.12	0.00	6	0	54.84	83.1	0	10,679	29.303	29.856	28.793
1876	34.70	62.5	9.0	25	3	1.17	8.00	6	0	42.17	68.4	1	14,135	29.170	29.663	28.527
1877	25.60	62.5	7.5	9	0	3.05	0.00	8	1	46.77	73.4	0	9,178	29.255	29.751	28.563
1878	33.97	55.0	16.0	20	6	0.37	0.80	4	0	43.98	70.0	1	8,309	29.253	29.745	28.535
1879	33.49	53.0	20.5	4	0	1.80	0.00	3	0	48.49	73.8	0	12,861	29.094	29.631	28.604
1880	41.23	53.0	8.0	26	4	0.34	0.50	0	0	58.60	75.9	1	12,192	29.255	29.722	28.713
1881	21.66	62.5	5.0	12	0	0.70	2.00	6	0	51.72	66.3	1	11,673	29.200	29.768	28.700
1882	32.68	65.0	14.0	28	5	0.73	5.50	7	0	53.55	79.1	1	12,526	29.253	29.741	28.526
1883	19.65	47.0	21.5	21	7	1.20	12.00	7	0	41.42	73.9	3	14,368	29.313	29.881	28.735
1884	20.99	57.0	5.5	20	3	1.20	4.50	6	0	42.88	74.7	2	11,669	29.202	29.719	28.631
Mean	26.64	57.2	5.5	20	3	1.20	4.50	6	0	42.88	74.7	2	11,669	29.202	29.719	28.631

In the column of minimum temperatures a dash indicates temperature below zero. In the column of winter days is given the number of days whose mean temperature was below 32°.

Chart 1. Tracks of Low-Barometer Areas, January, 1881.

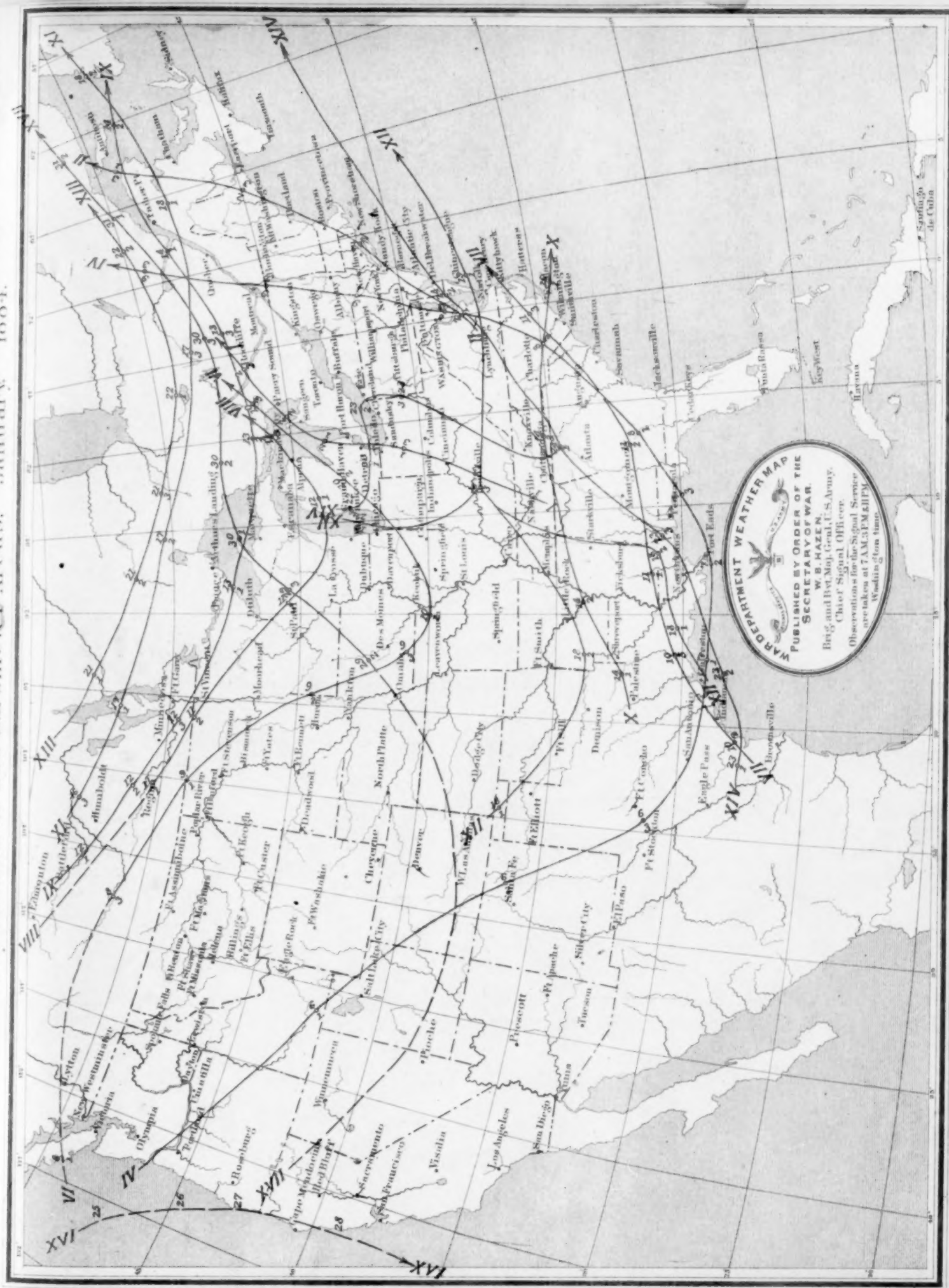


Chart II. Ocean Storm Tracks. January 1884.

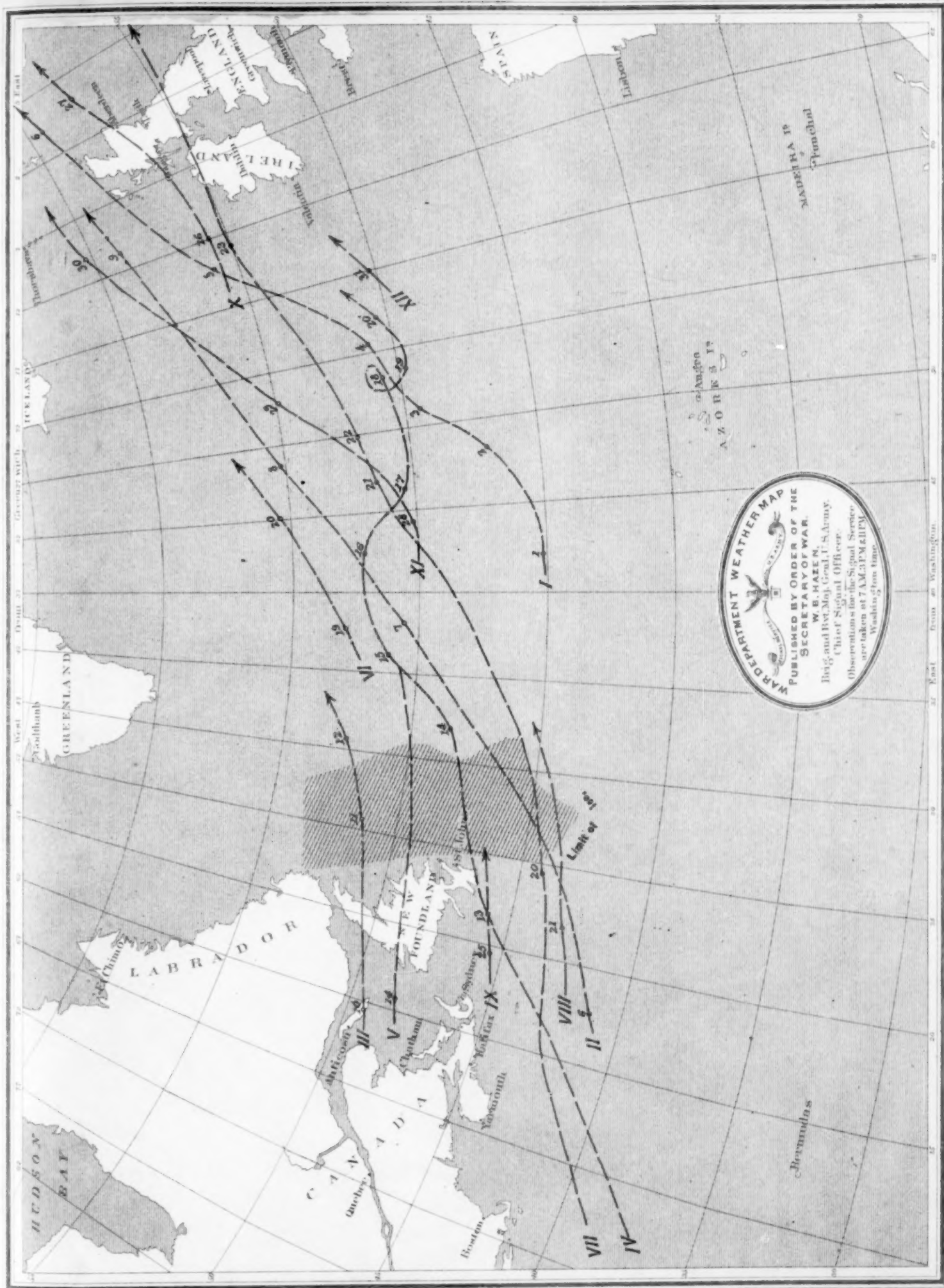


Chart III. Isobars, Isotherms, and Winds. January, 1881.

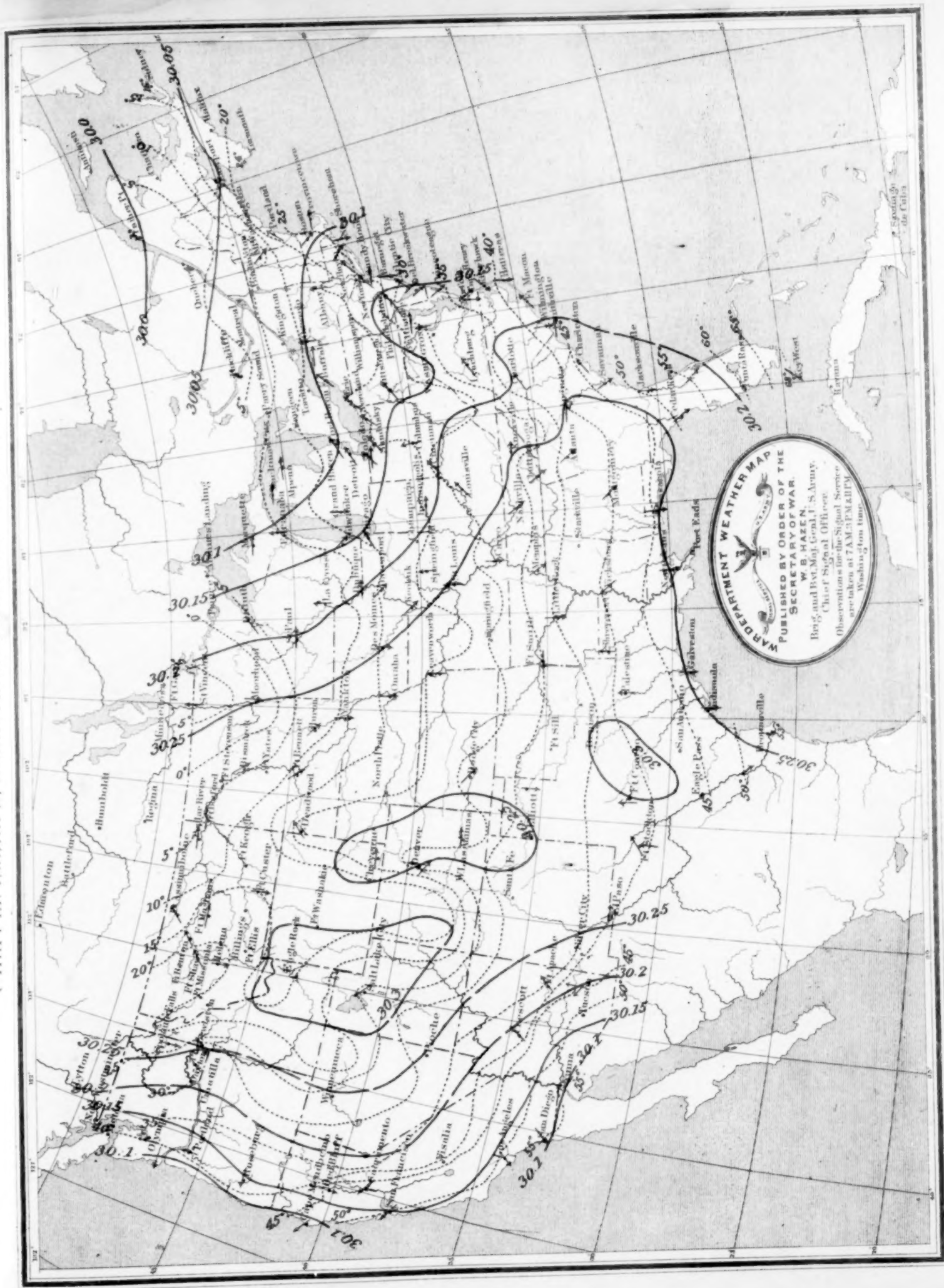


Chart IV. Precipitation, January 1884.

